Spatial patterns of population growth and agricultural change in the Punjab, Pakistan, 1901-72

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ABSTRACT

The present study looks into the two most conspicuous aspects of the Punjab's geography - population and agriculture - and their interrelationship. With a population of almost 49 million, the Punjab is not only the leading province of Pakistan but contains more people than, for example, Egypt, Iran, Turkey or Thailand. Furthermore, with 69 per cent of Pakistan's net sown area, the Province contains three fifths of the nation's agricultural labour force and produces three fourths of its wheat, one half of its rice and two thirds of its total foodgrains. The Punjab is thus not only Pakistan's "granary" but also one of the world's principal agricultural regions where continuous rapid population growth has created an unabated challenge to economic development.

The analysis is directed first to the evolution of the region's population, which increased relatively slowly before 1921, but thereafter grew rapidly in the wake of sharply falling mortality. Regional variations in the Punjab's population growth have been connected not only with the rising rate of natural increase, but also with large scale redistribution due to agricultural expansion via canal irrigation development. Agricultural change bearing a stronger interconnection with rural population change, the urban-rural differential of population growth is studied in detail and this assists in providing an understanding of the patterns of population distribution.

Secondly, the investigation focusses on the performance of the region's agriculture which, by employing more than half of Pakistan's total labour force and contributing almost one third of its GNP, plays a dominant role in the nation's development effort. In view of the multidimensionality of agricultural development, variations in the spatial patterning of land utilization and productivity since Independence are analyzed with respect to physical inputs as well as social and institutional forces.

Finally, the interrelationships between the region's population growth and agricultural change for the period 1961-72 are investigated with a view to disentangling their nature and intensity. The Province's rapid population growth has not only exerted pressure on its resources and thus created a challenge to development, but has also multiplied its agricultural labour force, the effects of which on land utilization and productivity are analyzed. Correlation analysis reveals important regional variations in the interrelationships between population growth and agricultural change.

SPATIAL PATTERNS OF POPULATION GROWTH AND AGRICULTURAL CHANGE IN THE PUNJAB, PAKISTAN, 1901-72

A thesis submitted to the Faculty of Social Sciences, University of Durham, in candidacy for the degree of Doctor of Philosophy.

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TO MY FATHER

for his life-long zeal for my education

&

TO MY MOTHER

for all the sacrifices ---

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M.A.M.

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LIST OF ABBREVIATIONS

ADBP	Agricultural Development Bank of Pakistan
ADC	Agricultural Development Corporation
ALF	Agricultural Labour Force
BCG	Bacillus of Calmette and Guérin (inoculation for Tuberculosis)
CBR	Crude Birth Rate
CDR	Crude Death Rate
CES	Census Evaluation Survey (1972)
CS	Cross-sectional Survey (of the PGE)
CSO	Central Statistical Office (Government of Pakistan)
DCR	District Census Report
FATA	Federally Administered Tribal Areas
FCTI	Federal Capital Territory Islamabad
GNP	Gross National Product
GPP	Gross Provincial Product
GRR	Gross Reproduction Rate
HED	(The) Housing Economic and Demographic (Survey 1973)
LR	Longitudinal Registration (of the PGE)
MGRR	Marital Gross Reproduction Rate
MTFR	Marital Total Fertility Rate
NWF	North West Frontier (Province)
PEQC	Post Enumeration Quality Check (Survey 1961)
PGE	Population Growth Estimation (Project 1961)
PGS	Population Growth Survey (1968)
PIDB	Pakistan Industrial Development Bank
PIDC	Pakistan Industrial Development Corporation
RDR	Rural Dependency Ratio
SCARP	Salinity Control And Reclamation Project
TDR	Total Dependency Ratio
TFR	Total Fertility Rate
UBDC	(The) Upper Bari Doab Canal
WAPDA	Water And Power Development Authority

GLOSSARY OF VERNACULAR AND OTHER TERMS

Bajra	A millet
Bar	Scalloped interfluve
Barani	Rain-fed agriculture
Bet	Active flood plain of a river
Bhangar	Old alluvium
Bunya	Hindu moneylender or merchant
Culturable	Cultivable
Doab	Interfluve - the land confined by two rivers
Gram	A leguminous crop
Grama	Estate
Jagir	Feudal estate
Jagirdar	Feudal estate owner
Jowar	A millet
Junglis	Nomad graziers of the pre-canal period
Kankar	Modular limestone
Khaddar	New alluvium also Active flood plain of a river
Kharif	Summer cropping season (harvested in autumn)
Loo	Hot summer wind
Mandi	Market
Mash	A leguminous crop
Masoor	A leguminous crop
Maund	Measure of weight equal to 0.0373 tonne
Moong	A leguminous crop
Muhajirs	Muslim refugees from India
Purdah	Secrecy/Seclusion of women
Rabi	Winter cropping season (harvested in spring)
Raj	(British) rule (in the Indo-Pakistan subcontinent)
Tehsil	Administrative subdivision of a district
Thal	Vast expanse of sandy desert
Thana	Police station

EXPLANATORY NOTES

1. In 1977 two new administrative districts, Kasur and Vehari, were created in the Punjab, raising the total to twenty one. However, in this analysis the division of the Province into the nineteen districts as existing in 1972 is followed.

2. In 1977 Lyallpur was renamed as Faisalabad and in 1978 Campbellpur as Attock. However, in this study the old nomenclature has been retained.

3. In earlier official reports Sahiwal has been referred to as Montgomery, Sargodha as Shahpur, Firozwala as Shahdara and Liaqatpur as Allahabad.

4. In some official publications, Kot Addu is written as Kot Adu and Dipalpur as Depalpur.

CHAPTER I

INTRODUCTION

1.1. BACKGROUND

Economic development in Pakistan is confronted with the challenge of rapid population growth. A massive population base, coupled with a high annual growth rate of over three per cent, adds more than two million people every year to the country's existing population size. The population of the country nearly doubled, rising from 16.6 million to 33.5 million between 1901 and 1951, at an average annual rate of 1.4 per cent, and then nearly doubled again between 1951 and 1972, rising at the alarming rate of 3.1 per cent per year to reach 65.3 million at the latter date. During the period 1975-79, the annual growth rate averaged 2.8 per cent, higher than in any neighbouring country except Iran. (1)

Since rapid population growth brings in its wake numerous problems, such a substantial increase in population numbers or the "population explosion" has exerted considerable pressure on the country's economy. It has diluted the outcome of the socioeconomic reforms introduced from time to time and frustrated all efforts aimed at achieving self-sufficiency in basic foodstuffs.

Contributing almost one third of the GNP and employing 56.2 per cent of the nation's workforce(2), agriculture is the principal economic activity of Pakistan. Three quarters of the total population live in villages and derive their livelihood directly or indirectly from agriculture and agriculture supplies over 90 per cent of the country's food requirements. Thus, despite the substantial structural transformation of the economy during the past three decades, agriculture still plays a vital role in the nation's economic development. Successive governments in Pakistan have, therefore, given major consideration to the agricultural sector in their planning strategies.

In an agro-rural economy like Pakistan's, no other sector is perhaps as exposed to the effects of a "population explosion" as is agriculture. It is therefore argued that the reason why Pakistan is falling short of its food target

every year is not its unrealistic targets nor a weak potential, but rather an unprecedented rate of population increase. (3)

The challenge of a substantial population growth is, to a large extent, realized in Pakistan's official circles. Considerable effort has, therefore, been made to avert the negation of socioeconomic reform by rapid population growth or, in other words, to bridge the ever increasing gap between the economic targets and achievements. (4)

In order to understand the true dimensions of this challenge, there is strong need for an analysis of the relationship between population and development. It is unfortunate, however, that not many inquiries have been conducted in this area. In particular, there is an acute paucity of such works at a provincial or a regional level. Further, an examination of the literature reveals that very little contribution has been made by Pakistani geographers to the study of the national population problem vis-a-vis the economic progress of the country.

1.2. STATEMENT OF THE PROBLEM

The conditions outlined above call for investigation into the population problem on a new pattern, with an individual approach and a specialized methodology. Given the marked regional variations which exist in both the demographic situation and the economic climate, there is strong need for such an investigation to be region-oriented. It is in this perspective that the present study has been undertaken. It addresses itself to the question of population growth in relation to economic change in the Punjab, the most populous province of Pakistan, with special emphasis on the development in the agricultural sector.

The choice of the Punjab has been dictated by the fact that, with 57.6 per cent of the national population and 183 persons per sq. km. it is the leading province of Pakistan in both population size and density. With the largest population base and a growth rate very close to that of Pakistan as a whole, it is numerically the fastest growing region. Economically the heart and geopolitically the raison d'être of Pakistan, the land-locked Punjab is the most prosperous and

the most influential province in the country. Occupying almost one fourth of the national territory, it has the largest net sown area - 9.9 million ha. or 69.2 per cent of Pakistan's total. Furthermore, over 48 per cent of the Punjab's total area is net sown, compared with 19 per cent of Sind, 13 per cent of the NWF, one per cent of Baluchistan and 18 per cent of the country as a whole. (5)

As well as being the principal supplier of manpower and the "sword arm" of the country in providing the majority of the officers and men to the armed forces, the Punjab is also the national granary. It produces over 76 per cent of the country's wheat, 46 per cent of its rice, 46 per cent of its maize and 67 per cent of its total food grains. In addition, it produces over 71 per cent of the country's cotton, 70 per cent of its sugarcane and 33 per cent of its tobacco.(6) All the major rivers of Pakistan passing through it, the Punjab occupies a dominant part of the Upper Indus Plain which has one of the most elaborate irrigation systems in the world. 71 per cent of the total irrigated and 68 per cent of the canal irrigated area of Pakistan lie in the Punjab. (7)

The composition of the Punjab's Gross Provincial Product (GPP) is skewed towards agriculture which, being a primary resource base, is not only the largest sector but is indeed the mainstay of the Province's economy, contributing roughly 35 per cent of the GPP in 1974-5. (8) Punjab's dominant share in other sectors of the national economy notwithstanding, its agricultural sector plays a crucial role in national development.

The Province is ethnoculturally homogeneous and, although minor cultural variations occur, based mainly on the dialects of the Punjabi language; (9) language, race, tribal organization and other variates play a less important part in differentiating groups here than in Pakistan's other provinces. (10) About 98 per cent of the Punjab's population is Muslim, about 75 per cent rural and almost 76 per cent depends for its income, directly or indirectly, on agriculture. These facts further establish the eco-demographic homogeneity of the Province. The author's first-hand knowledge of the Province, in that he belongs to

it and has travelled widely within it, is an added advantage for the choice of the Punjab.

1.3. OBJECTIVES OF THE STUDY

There are two main objectives of the present study. First, it attempts to describe and analyze the spatial patterns of population growth and agricultural change in the Punjab. Second, it aims to compare, understand and analyze the relationships between population change and agricultural variables and thus tries to examine how changes in these two families of variables are interlinked.

The relationships between population and agriculture - whether agriculture can feed the teeming millions and provide them the means of livelihood - has been the subject of debate for centuries. In the remote past, Confucius (551-478 BC) and Plato (c.427-347 BC), for instance, paid attention in their respective areas and times to the vital question of population growth vis-a-vis the then prevalent economic climate. However, this question received rather scanty attention resulting in a few scrappy accounts of the relationships between the two variables. Further these studies were mostly of a "localized" nature and for a limited time period; and presented vague thought and speculation rather than deep observation and analysis.

With the publication of Malthus' Essay , almost two centuries ago, the question of the relationship between population and development once again caught the limelight. Unleashing a storm of controversy, the Essay evoked an immense quantity of literature for and against. The results of various investigations conducted in this area fluctuate between the pessimistic and optimistic extremes, without however fully achieving a real synthesis of the complex relationships between the population and development variables. There is, therefore, greater need to unravel the diverse relationships between these two sets of variables. In the present study, an attempt has been made to understand and analyze such interrelations. Since an overwhelming majority of the Punjab's population lives

Fig 1·1(b) ADMINISTRATIVE HIERARCHY OF THE PUNJAB, 1972

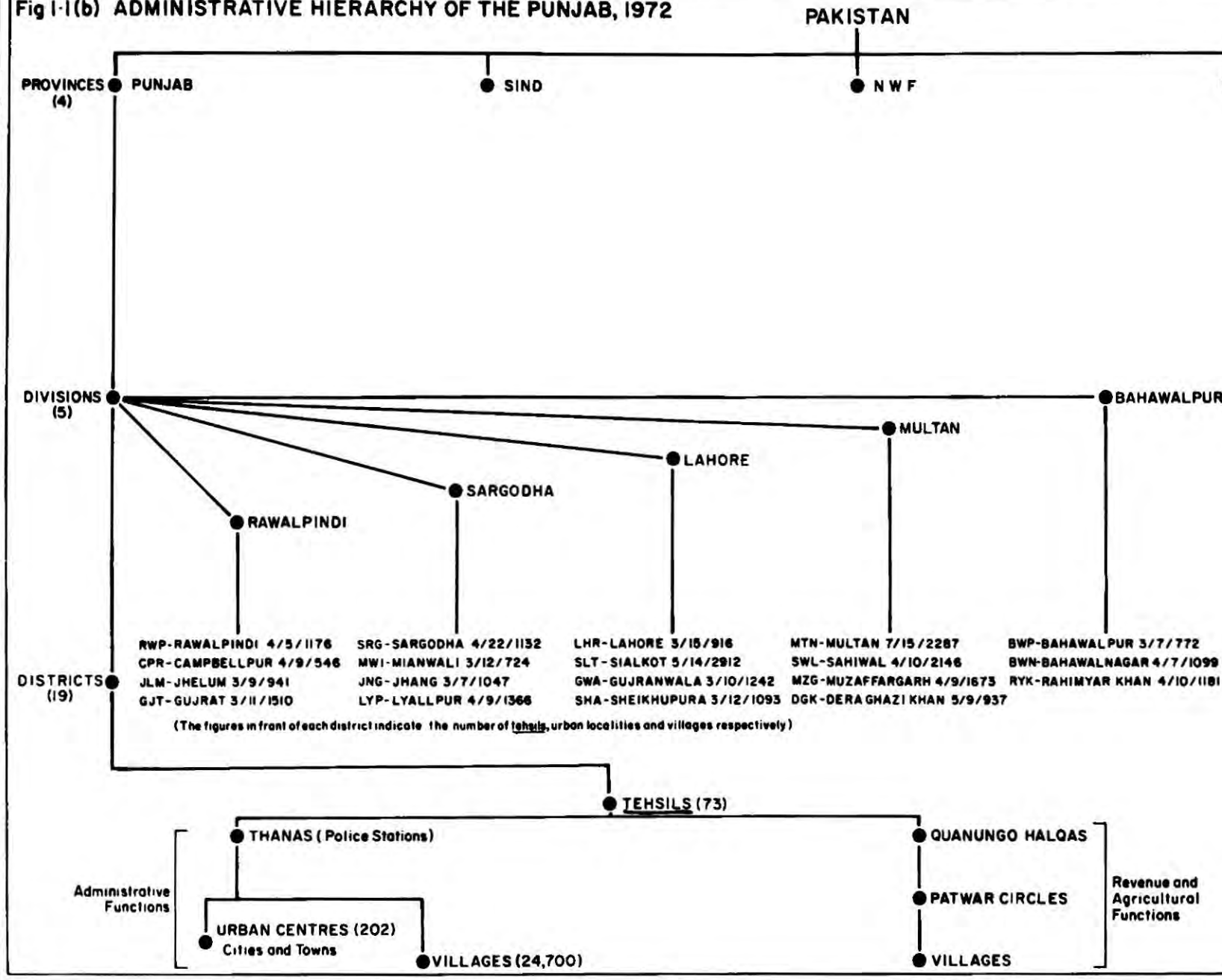

Fig 1·1 (a) THE PROVINCES AND DIVISIONS OF PAKISTAN, 1972

in villages and earns its livelihood in the rural sector, the interactions between population growth and agricultural development are of obvious importance and promise an insight into the region's development process.

1.4. LEVELS OF RESOLUTION : AREAL UNITS AND THEIR CHARACTERISTICS

In Pakistan, as elsewhere, data on population and economic variables have traditionally been collected and published on the basis of administrative units. Any other type of functional areal division has been virtually non-existent.

Administratively, Pakistan is divided into four provinces : the Punjab, Sind, Baluchistan and the North West Frontier. In addition, there are two smaller units, the Federally Administered Tribal Areas (FATA) and the Federal Capital Territory Islamabad (FCTI). Each of the four provinces is, in turn, divided and subdivided into divisions and districts (Fig. 1.1(a)).

Of all these administrative areas, the district forms the base of the entire administrative hierarchy. Headed by a civil servant known as the Deputy Commissioner, it has been, since British days, the most important administrative unit and the keystone of the administrative structure. Because of the perpetuation of the inherited British administrative system, the district is still the basic unit of administration and the focal point of all social, cultural, economic, administrative and developmental activities. Furthermore, this administrative reality has been accepted as the basis for all census publication programmes since 1961, when the publication of a separate census report for each district (DCR) began. (11) Data concerning agriculture and other economic aspects are also published on a district basis.

Each district is subdivided into tehsils which are further divided into thanas or police stations for the sake of administration, and into quanungo halqas and patwar circles for agricultural and revenue purposes. The urban centres are categorized into towns and cities and their local government functions under the town and municipal committees respectively, but they also fall within the broader set-up of the respective tehsil and district administrations. A number

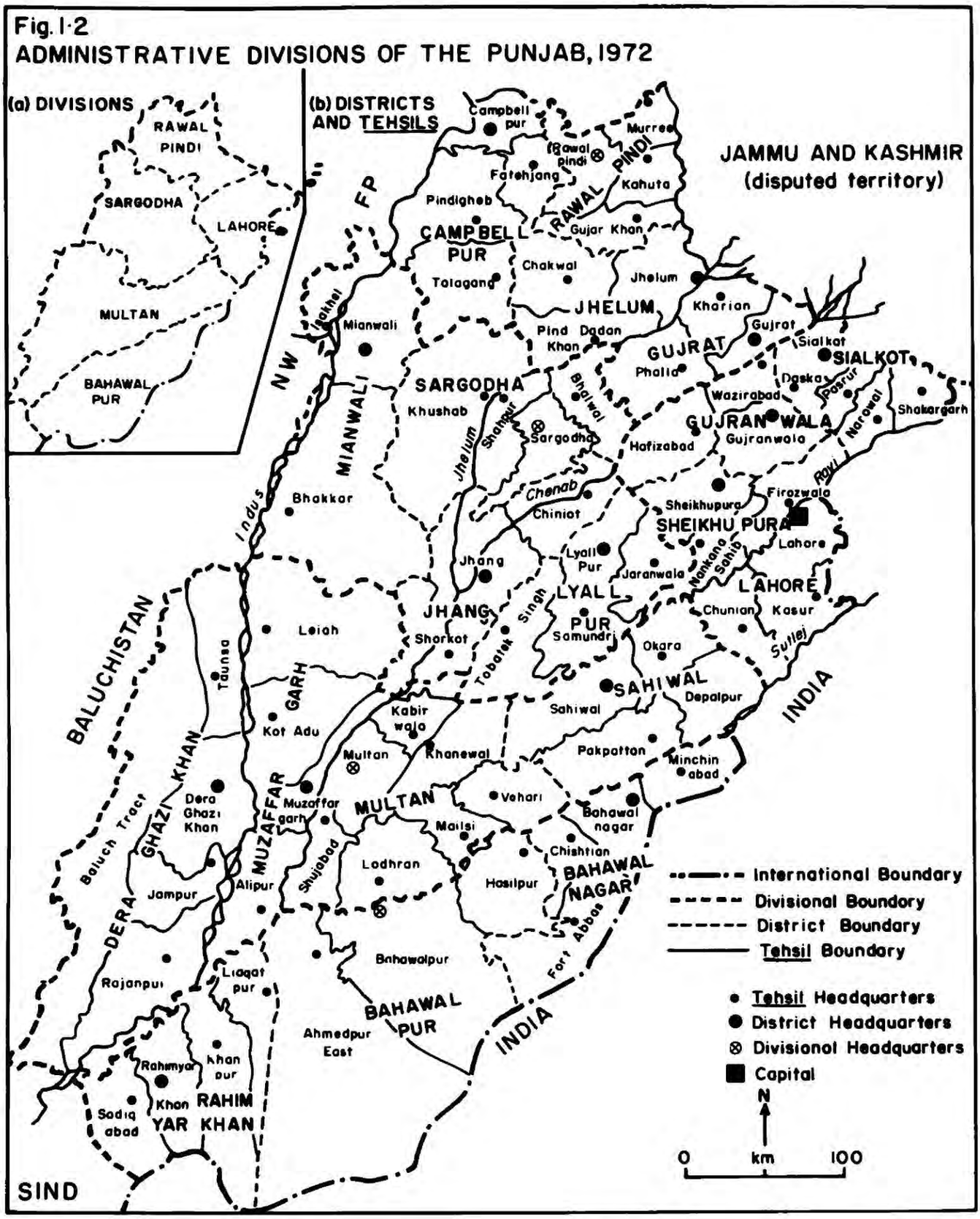
Fig. 1·2
ADMINISTRATIVE DIVISIONS OF THE PUNJAB, 1972
(a) DIVISIONS
RAWAL PINDI
SARGODHA
LAHORE
MULTAN
BAHAWAL PUR
(b) DISTRICTS AND TEHSILS
JAMMU AND KASHMIR (disputed territory)
N.W.F.P.
BALUCHISTAN
SIND
INDIA
INDIA
Campbell pur
Murree
Rawal pindi
Fatehjang
Kahuta
Pindigheb
CAMPBELL PUR
RAWAL PINDI
Gujar Khan
Chakwal
Talagang
Jhelum
JHELUM
Khurian
Gujrat
Sialkot
Jaskhel
Mianwali
Pind Dadan Khan
GUJRAT
SIALKOT
Phalia
Daska
Pasrur
Wazirabad
Shakargarh
Narowal
MIANWALI
SARGODHA
Khushab
Bhalwal
Shahpur
Jhelum
Sargodha
GUJRANWALA
Gujranwala
Hafizabad
Ravi
Chenab
Firozwala
Sheikhupura
Chiniot
Bhakkar
Indus
SHEIKHU PURA
Lahore
Jhang
Lyall Pur
Jaranwala
Nankana Sahib
LAHORE
JHANG
LYALL PUR
Singh
Chunian
Kasur
Leiah
Shorkot
Toba tek
Samundri
Okara
Sutlej
Tounsa
SAHIWAL
Depalpur
Kabir wala
Sahiwal
Kot Adu
GARH
Multan
Khanewal
Pakpattan
Minchin abad
Dera Ghazi Khan
Muzaffar garh
MULTAN
Vehari
Bahawal nagar
Mailsi
Chishtian
Baluch Tract
GHAZI KHAN
MUZAFFAR
Shujabad
Lodhran
Hasilpur
BAHAWAL NAGAR
Jampur
Alipur
DERA
Fort Abbas
Bahawalpur
Rajanpur
Liaqat pur
BAHAWAL PUR
Ahmedpur East
Rahimyar Khan
khan pur
Sadiq abad
RAHIM YAR KHAN
International Boundary
Divisional Boundory
District Boundary
Tehsil Boundary
Tehsil Headquarters
District Headquarters
Divisional Headquarters
Capital
N
0
km
100

of army cantonments classed as urban centres do not however fall within the jurisdiction of district administrations. Their local administration is instead run by cantonment boards. Figure 1.1(b) shows the administrative hierarchy in the region. As is clear, a division is higher than a district on the administrative scale and comprises a number of districts. Being under the charge of a civil servant known as the Commissioner, a division has been called a "Commissioner's Division" in some old official publications.

As Figure 1.2 reveals, the Punjab is divided into five divisions : Rawalpindi, Sargodha, Lahore, Multan and Bahawalpur, in order from north to south. These are subdivided into 19 districts which are in turn divided into 73 tehsils. According to the 1972 Census, there were 202 urban centres. Population data are available for all these units.

Population data manifest a great deal of variation at different levels of areal units. This has a great bearing on their comparability and, therefore, influences geographical analysis. The contrasts in various variables at different levels in 1972 are presented in Table 1.1. It is obvious that such contrasts are more striking at the lowest i.e. the tehsil level than at the highest, divisional level. At the divisional level, for instance, the largest population size in 1972 was more than 2½ times the smallest, whereas at tehsil level the largest population size was 40 times the smallest. Further, such variations were more pronounced in the case of urban than in total or rural populations. The combined population of the five top ranking tehsils was eleven times that of the five lowest ranking tehsils. In urban population such a comparison showed a far greater contrast and the five top tehsil urban populations together were 102 times that of the five tehsils at the bottom.

Not only are the population sizes of these areal units markedly uneven but their territorial sizes also exhibit considerable contrasts (Table 1.1). The largest tehsil, Bahawalpur, is almost 24 times the size of the smallest, Murree. The five largest tehsils occupy 23 per cent of the Province's area while the five smallest tehsils contain only 2 per cent. Similarly, the agricultural area

TABLE 1.1 AREA, POPULATION AND SOWN AREA OF THE LARGEST AND SMALLEST AREAL UNITS OF THE PUNJAB, 1972

Areal unit	Variable	Largest			Smallest			Ratio Largest/Smallest
		Name		% of Punjab	Name		% of Punjab	
Division	Area (km^2)	Multan	64,292	31.3	Lahore	23,070	11.2	2.8
	Tot.Pop.	Lahore	9,834,836	26.2	Bahawalpur	3,543,796	9.4	2.8
	Urb.Pop.	Lahore	3,641,420	39.7	Bahawalpur	593,325	6.5	6.1
	Rur.Pop	Multan	8,012,786	28.2	Bahawalpur	2,950,471	10.4	2.7
	Pop.Den.(Per km^2)	Lahore	426	-	Bahawalpur	78	-	5.5
	Net sown area (000 ha)	Multan	2,895	29.1	Rawalpindi	1,349	13.6	2.1
District	Area (km^2)	Bahawalpur	24,830	12.1	Rawalpindi	5,286	2.6	4.7
	Tot.Pop.	Lyallpur	4,241,785	11.3	Campbellpur	981,734	2.6	4.3
	Urb.Pop.	Lahore	2,421,507	26.4	Muzaffargarh	119,888	1.3	20.2
	Rur.Pop.	Lyallpur	3,188,769	11.2	Bahawalpur	846,184	3.0	3.8
	Pop.Den.(Per km^2)	Lahore	654	-	Bahawalpur	43	-	15.2
	Net sown area (000 ha)	Multan	1,087	10.9	Rawalpindi	269	2.7	4.0
Tehsil	Area (km^2)	Bahawalpur	15,475	7.5	Murree	653	0.3	23.7
	Tot.Pop.	Lahore	2,587,621	6.9	Baluch Tract	64,695	0.2	40.0
	Urb.Pop.*	Lahore	2,198,890	23.9	Kahuta	8,097	0.1	271.6
	Rur.Pop.	Tobatek Singh	940,845	3.3	Baluch Tract	64,695	0.2	14.5
	Pop.Den.(Per km^2)	Lahore	1,461	-	Baluch Tract	6	-	243.5
Urban Centre	Population	Lahore	2,169,742	23.6	Sakesar Cant.	1,372	0.01	1581.4

* one tehsil (Baluch Tract) has no urban population.

SOURCE : Computed from 1. District Census Reports 1972 (19 vols.)
2. Season and Crop Reports 1970-1/1974-5 (5 vols.)

exhibits a high degree of variation between different areal units. Net sown area in Multan district, for instance, was 4 times that of Rawalpindi during the period 1970-1/1974-5 (Table 1.1).

While the population data are available down to tehsil level, statistics regarding agriculture and other economic variables are available at the divisional and district levels only. This does certainly limit the resolution of population change vis-a-vis economic development to the "macro" and "meso" scales. However, in the case of population variables, an attempt has been made to take the analysis down to the micro scale i.e. the tehsil level.

In order to express the Punjab's importance in Pakistan, frequent reference has been made to the population change and economic activity in the other provinces

To sum up, the following levels of resolution can be discerned in the present inquiry.

(i) General pattern for Pakistan and for the Punjab as a whole
(ii) Variation at the divisional level (Macro scale)
(iii) Variation at the district level (Meso scale)
(iv) Variation at the tehsil level (Micro scale)

1.5. TIME PERIOD OF ANALYSIS

The major emphasis in the present study is on the intercensal periods 1951-61 and 1961-72. In order to have a full comprehension of the recent agro-demographic changes, however, an attempt has been made to approach them historically. But, although the region's population statistics are available since the middle of the nineteenth century, the present study is restricted to the twentieth century. This was decided because of the problems arising from the frequent revision of boundaries of the areal units affecting intercensal comparability.

Thus, occasionally extended back to the latter half of the nineteenth century for a proper appraisal of certain population and economic aspects in the

wider context of the subcontinent, the proper study is confined to the twentieth century. The maximum detailed analysis, however, has been conducted for the post-Independence intercensal periods of 1951-61 and 1961-72, with a greater emphasis on the latter. An attempt has also been made to update the statistics by including the post-1972 population estimates and other available information.

1.6. SOURCES AND NATURE OF DATA

Reliable statistical information is of vital and fundamental importance on every research front. It is no exaggeration to say that in the human and social sciences such information provides the life-blood of the whole body of resolution. This is increasingly true of geography which has, through a quantitative revolution, become progressively more of a quantitative nature.

It is also probably true that no other aspect of geography makes a more elaborate use of statistical information than does population geography. A study of population conducted in the geographic perspective and framework and dealing with the spatial variations in the demographic and non-demographic aspects of human populations and their interactions with the socioeconomic variates in a given area does, in fact, rely heavily on the availability of a statistical base.

In the present inquiry, the trends and patterns of population growth with respect to time and space have been studied in their socioeconomic context and in quantitative terms. The method being geographical, statistics provide the base for the entire structure of the study. It is, therefore, appropriate at this stage to throw light on the sources and nature of the quantitative material.

Keeping in view the vastness of the area, the considerable variety of data required and a probable low degree of response from the people, a field survey for data collection in such a study is not a practical idea. Thus there is no choice other than recourse to the published data. The present study is, therefore, primarily based on official data from the census and other government sources. Nevertheless, an effort has also been made to tap the information from

private, autonomous and semi-autonomous organizations, individual research studies and numerous special reports. For convenience, the sources have been classified into two categories i.e. population statistics and agricultural statistics and these are now discussed separately.

1.6.1. Population Statistics

1.6.1.1. Census

The idea of holding a periodic enumeration of people was not unknown in the Indo-Pakistan subcontinent in ancient times when the rulers of the country, impelled by military requirements, for taxation purposes or for a variety of other reasons, attempted to enumerate the population and their households. This is supported by numerous historical accounts. (12)

Megasthenes, the Greek envoy despatched to the Mauryan court in c.300 BC by Alexander's general, Seleucus Nicator, wrote a detailed account of Indian life which, being the first authentic and connected description of the sub-continent by a foreign traveller, is of great significance. During his long stay in the Mauryan Court, Megasthenes came across men who were assigned by the Indian rulers to the job of collecting census and vital statistics:

> "The third body of superintendents consists of those who inquire when and how births and deaths occur, with the view not only of levying a tax but also in order that births and deaths among both high and low may not escape the cognizance of Government." (13)

The testimony of Megasthenes is amply corroborated by the relevant account given in Kautilya's treatise, Arthasastra (c.300 BC). It seems that the then census operation was not merely a periodic event but was rather in the nature of a permanent institution run by a large and permanent department. (14)

During the greater part of the Mauryan dynasty (c.322-c.183 BC), motivated by the strong administration, the system of enumeration of people seems to have remained operative and the State department as well as the civic bodies entrusted with the job of collecting statistics, particularly about births and deaths,

continued functioning. No detailed statistical record of these ancient enumerations however exists.

The history of systematic census-taking in the subcontinent in the modern period goes back to the mid-nineteenth century, though a limited beginning had been made in 1822, when an attempt at a regular enumeration was made in Madras Presidency, following the firm establishment of the East India Company rule.

The population of the Punjab was enumerated for the first time on 1st January 1855. It was, in fact, a sort of "exercise" to count roughly but, as far as possible, accurately the number of people in the Province. The second attempt, which could be termed as the first "all India" census, was a non-synchronized operation held in different parts of the subcontinent during the period 1868-72. In most parts of the Punjab, it was held on 10 January 1868. Despite its low quality, it established a statistical base and thus paved the way for the first regular census, which was conducted in 1881. Since then, systematic censuses have been held at ten-yearly intervals except Pakistan's latest census which was carried out after an intercensal gap of 11 years and 8 months (Table 1.2).

Following is a brief resumé of the censuses held in the Punjab since 1855.

CENSUS OF 1855

In 1855, no elaborate planning or preparation for a census operation was made. The enumeration was held on the night of 31 December 1854/1 January 1855. It was rather a "rough count" since no attempt was made to record particulars separately for each enumerated person. Instead, the head of the house was made the source of information about the number of persons sleeping under his roof. In view of the partial and hasty coverage, the quality of data cannot be ascertained. Nevertheless, it was acclaimed to be the first enumeration since the reign of the Mughal emperor, Akbar (1556-1605). [15]

TABLE 1.2 POPULATION CENSUSES HELD IN THE PUNJAB, 1855-1972

Serial Number	Census Year	Census Date	Inter-Censal Period*	Census Method	Remarks
1	1855	1 Jan.1855	-	de facto	"Rough" count
2	1868	10 Jan.1868	13.0.9	de facto	non-synchronous
3	1881	17 Feb.1881	13.1.7	de facto	near-synchronous
4	1891	26 Feb.1891	10.0.9	de facto	near-synchronous
5	1901	1 Mar.1901	10.0.3	de facto	near-synchronous
6	1911	10 Mar.1911	10.0.9	de facto	near-synchronous
7	1921	18 Mar.1921	10.0.8	de facto	near-synchronous
8	1931	26 Feb.1931	9.11.8	de facto	near-synchronous
9	1941	1 Mar.1941	10.0.3	de facto	near-synchronous
10	1951	9-28 Feb.1951	10.0.0	de jure	synchronous - First Census of Pakistan
11	1961	12-31 Jan.1961	9.11.0	de jure	synchronous - Second Census of Pakistan
12	1972	16-30 Sep.1972	11.8.0	de jure	synchronous - Third Census of Pakistan

* years. months. days

SOURCES:
1. Census of India 1881-1941 (7 vols)
2. Census of Pakistan 1951
3. Census of Pakistan 1961
4. Census of Pakistan 1972

CENSUS OF 1868

The second population enumeration in the Punjab was held on 10 January 1868. As in 1855, the particulars of each person were not recorded separately. The statistics collected, therefore, can not be regarded as wholly reliable. (16) The experience gained however was very valuable and this census provided a base for the first systematic and regular census, conducted in 1881.

CENSUS OF 1881

Held on the night of 17/18 February, this was, in fact, the first regular and systematic census of the whole subcontinent. Conducted with adequate thoroughness and detail, it produced fairly accurate results at least in the actual number of people by sex. (17) It was a near-synchronous operation since, except in a very few difficult areas, enumeration was simultaneous in all areas. The published volumes contained statistics of the density and distribution of population, urban-rural character, age and sex composition, marital status, literacy and education, religious groupings and migrations.

CENSUS OF 1891

This was held on the night of 26/27 February and was technically improved by the issue of more detailed instructions to the enumerators, refinement of definitions and expansion of the questionnaire so as to include questions on race and parent's tongue. More elaborate arrangements ensured completeness. The non-synchronous area became smaller. The results were published in 1892 and contained elaborate data about the same aspects as the preceding census.

CENSUS OF 1901

The first census of the twentieth century was taken on the night of 1/2 March 1901, or ten years and three days after the previous enumeration. Arrangements for the operations were further elaborated and the non-synchronous area further reduced. A "slip system", to facilitate tabulation through hand sorting, was introduced. The published volumes contained, in addition to the

aspects covered in the previous censuses, data on caste, tribe, race, types of marriage and common infirmities.

CENSUS OF 1911

No significant change was made from 1901 in the method of enumeration. However, a notable addition was the inclusion of a separate schedule for collecting particulars of the workforce employed in the industrial units and factories with 20 or more staff. The census operation commenced on 9 April 1910, with the house numbering followed by the training of the census staff and the preliminary enumeration. The census itself was held on the night of 10/11 March 1911 when the record of the preliminary enumeration was corrected. The results were published in 1912, when detailed statistics appeared on the population distribution by geographical areas and by residence, movement and growth of population, age and sex composition, linguistic and religious classification, caste and tribe, education and literacy as well as occupations and infirmities. The census was commended for its completeness and a high degree of accuracy.

> "The census of India is remarkable for a standard of accuracy probably not attained elsewhere, for the comprehensiveness of the data collected, for the exhaustive analyses and for its interesting, informing and authoritative deductions." (18)

CENSUS OF 1921

The arrangements for this census actually started in July 1920, when a complete list of households and a census code were prepared. In August, a pamphlet of instructions was brought out, and on 15 September the numbering of houses commenced. Preliminary enumeration in the rural tracts took place throughout February 1921, while in the towns it commenced and finished a fortnight later. The final census took place on the night of the 18/19 March. However, in inaccessible areas this had been completed in the autumn of 1920. Thus, it was, like the preceding censuses, not a completely synchronous operation. However, it could be regarded as "near-synchronous". The results were again published with maximum details on all the aspects as in 1911. In addition, data

pertaining to place of birth and common diseases were published.

CENSUS OF 1931

Preliminary enumeration for this census continued throughout January and until mid-February 1931. The final census, which was the process of checking and updating the entries already made, was held on the night of 26/27 February.

This census coincided with a period of political upheaval, marked by communal conflicts and civil disobedience. In addition, this was a period of economic depression. The census results were adversely affected by the Non-Co-operation Movement. Although the census operation itself was not considered so objectionable, the opportunity of harassing the Government was too good to be missed. (19) As a result, there was effacement of the census numbers on houses on a massive scale making the enumerators' job excessively difficult. Further, as a consequence of the Sarda (or Child Marriage Restraint) Act of 1927, which prescribed the minimum age of marriage at 18 for males and 14 for females, there was a decrease in the enumerated married population and an overstatement of ages. (20) Further, since the people knew that the guarantees and safeguards and political rights of various communities to be provided by the future constitution would largely depend on the census figures, different communities tried to inflate their numbers through wrong entries. In quite a few cases the enumerators did not hesitate to collaborate. Thus, there was a tendency to omit and suppress the actual figures through a boycott on the one hand and of artificial inflation on the other. However, the extent of overall omission, particularly in the Punjab, is believed to be very low. (21) The published documents contained statistics on the same aspects as in 1921.

CENSUS OF 1941

In all the censuses from 1881 to 1931, the final enumeration took place at night. In 1941, however, the final count was held in the day time, on the 1st March. In addition, there was another departure from previous practice. In

order to save time and money and to reduce the possibility of error and omission, the old census schedule was replaced by an enumeration slip. (22)

The intensity of the Civil Disobedience or the Non-Co-operation Movements which had affected the previous census had largely dissipated. However, the results of this census were affected by overreporting, since various communities tried to overrepresent their numbers for political considerations. Some aspects were, in particular, strongly affected by communal considerations, notably those concerned with language. It was decided, therefore, not to tabulate statistics on language. (23) The final publication of data which was greatly curtailed owing to the exigencies of war time, contained statistics regarding the distribution of population, town and country classification, sex distribution, religious composition and level of literacy.

In summary then, a regular census activity has been going on in the Punjab since 1881. Each census marked a degree of improvement over the preceding one in its areal coverage as well as in the scope and quality of the data collected. The 1931 and 1941 censuses, however, became the victims of the then political climate, resulting in underenumeration in the former and overreporting in the latter.

There are only a few post-census studies on the quality of the census data.(24) Although some of the greatest scholars of high repute were associated with the subcontinent's censuses,(25) all these censuses were planned by and held under the direct supervision of the Civil Service. The paucity of post-census studies could be partly due to the attitude of the civil servants who would not be inclined, particularly during a colonial rule, to encourage any degree of direct or indirect criticism on the functioning of the government machinery. In every census report, therefore, the respective census commissioner claimed a high level of accuracy in the census returns. And, given the general immobility of the population on the "census nights", a high degree of completeness of enumeration seems likely.

Regarding the subcontinent's population censuses to be thorough and a remarkable source of information, Davis (1951) estimated the extent of registration in various parts of the subcontinent in 1931. According to his estimates, 99.5 per cent of the British Punjab's population was registered in that year. (26) This certainly hints at the completeness of the population numbers. However, the accuracy of various population attributes such as age, marital status, literacy etc. is not easy to ascertain.

CENSUS OF 1951.

The first census of independent Pakistan was conducted in 1951, on a de jure basis. The main objective of this census was to assess the population strength of the new nation and to make available, for planning and other purposes, statistics on social, economic and educational aspects. It was, in a way, a "stock taking report" of the new country, envisaged to establish a standard model for the future as well as to gather statistics about the vast multitudes of the people displaced in the process and as a consequence of the Partition. (27)

The circumstances for such a gigantic operation were least favourable. The lack of statistics regarding Pakistan and especially for the province of the Punjab, which had been divided on Independence, made it imperative to adhere to the normal census season of early spring. (28) Thus, the enumeration was held between 9 and 28 February. This was the time when the government's administrative structure was in the formative stages. Further, owing to the large scale migration to and from the Punjab, the previous statistical information on population had become obsolete. The movement of population was still continuing and, even more than three years after Independence, thousands of muhajirs (refugees) were pouring into Pakistan, particularly into the Punjab. However, despite these abnormal circumstances, the unstable demographic situation, and the slender resources available, strenuous efforts by a devoted census staff coupled with a helpful public attitude resulted in the production of the essential population data.

In scope, this census covered almost the same grounds as the previous census of the subcontinent, a conspicuous departure being the omission of caste and race statistics. However, more detailed information on language, literacy, education, labour force and occupation was obtained and special attention was paid to the collection and publication of muhajirs' statistics. Although not evaluated in sufficient detail, the information collected on all these aspects was claimed to be reasonably accurate. However, owing to a certain degree of apathy and frustration in the organizational stages, especially in a few large urban localities, there was a possibility of some underenumeration. (29)

CENSUS OF 1961

Pakistan's second census was taken in 1961, again on a de jure basis, during 12-31 January. It was a synchronous operation, except in a few hilly areas where the enumeration had been accomplished earlier. A small part of Murree tehsil in Rawalpindi district was one such area, where the counting had been done between 15 November and 15 December 1960.

Considered to be much better planned, with its organization set-up far superior to that of 1951, this census obtained more detailed information particularly on education and labour force. Further, an elaborate publication programme was successfully accomplished within almost two years after the enumeration in which, in addition to the main census bulletins and reports, a separate census report for each district (DCR) was brought out for the first time. Thus, detailed statistics on age, sex, marital status, religion, birthplace, mother tongue, literacy, education, economic activity, occupation and fertility were published.

This census was followed by a Post Enumeration Quality Check (PEQC) Survey conducted by the Census Organization itself, on the presumption that making it known prior to the census date that the PEQC would be conducted, would help in improving the quality of the census. In addition, numerous inquiries were conducted on the operation and results of this census, most of which, while

pointing out a small number of pitfalls, generally praised the efficiency of the census organization and the standard of work. (30) However, some of these inquiries pointed out the extent of inaccuracy and inadequacy of data in certain areas of the census. In one such study, Krotki (1963) pointed out an 8.4 per cent underenumeration in Pakistan's 1961 census population. (31) Such findings are discussed at length in Section 3.2

CENSUS OF 1972

The third census of Pakistan, which was due in 1971, could not be held on schedule because of the unprecedented political chaos, economic turmoil and the accompanying deterioration of law and order before and after the disintegration of the country and severance of its Eastern Wing (East Pakistan). This census was, therefore, held only in West Pakistan (which now forms Pakistan), between 16 and 30 September 1972. It was completed in three phases. During the first phase (1-15 September 1972), households were listed; during the second phase (16-30 September), the "Big Count", a hundred per cent count of population, took place and during the third phase (August - November 1973), the Housing, Economic and Demographic (HED) sample survey was conducted. Another significant departure from the earlier censuses was the shortening of the enumeration schedule. It now included only six questions : the relationship with the head of the household, sex, age, marital status, religion and literacy. (32) This schedule was used during the "Big Count", while the data regarding housing and housing conditions, migrations, educational attainments, labour force, and fertility were collected on the basis of a sample during the final phase of the census. This sample consisted of 255,000 households out of which 122,000 were urban.

The 1972 census operation, therefore, dislodged the century-old census history of the area in two distinct ways; first, by increasing the normal 10 years intercensal period to 11 years and 8 months; and second, by including in the enumeration schedule the minimum number of questions ever asked in a population census. This census too was followed by a Census Evaluation Survey (CES)

conducted now by an independent organization. In addition, a number of investigations about the quality of census returns were conducted , some of which pointed out underenumeration,[33] while the others regarded this census to be overenumerated. [34] These are discussed in Section 3.2.

Although delayed by one year and 8 months due to the conditions mentioned above, this census enjoyed a more congenial climate than the country's earlier censuses. The census organization, which had by now attained the status of a permanent body, had a longer time for the planning and execution of its programme. The experience of the two earlier censuses in view, a marked improvement in method and technique was registered. Thus, due to the shorter census schedule, better planning and improvement in the areal coverage, the 1972 census is believed to have yielded better enumeration as compared to the 1961 census. However, in the publication programme, the census organization seems to have failed in meeting its targets due to some explained and unexplained snags.

A computer had been employed, for the first time, with a view to making available the census results correctly and expeditiously. It was envisaged that, by employing sophisticated machinery, new techniques and statistical expertise, the 1972 census results would be much better and quicker than the previous ones. But all such hopes were dashed since it took more than six years to publish the census results. A frustrating aspect of the published material is that there are a large number of discrepancies of data in various publications. The organization has obviously failed to maintain the pace and standard it had achieved in 1961. The publication of the Punjab's data, in particular, has suffered to a maximum degree, not only due to the longest delay but because of numerous errors and omissions as well. It seems as if the Punjab met an increased degree of apathy at the hands of the Census Organization, which is hard to explain.

Another serious set-back the 1972 census seems to have suffered was over-reporting in the smaller provinces, particularly in Sind and Baluchistan, reflected by an abnormal increment in their growth rates. The census operation

coincided with the time when the new constitution of the new ("East Pakistan less") Pakistan was in the making. Thus, it is quite likely that, in order to secure strong representation in the Federation, population might have been overreported or overcounted in these provinces.

1.6.1.2. Vital Registration

As in its population censuses, the region had a well developed system of vital registration since ancient times. There is ample evidence to the effect that a sort of complex and quasi-religious system of registering births, marriages and deaths remained operative through the ages in the subcontinent's self-sufficient rural communities. (35) However, the introduction of a systematic registration of vital events in its modern sense owes its origin to the British period. (36)

In the Punjab, registration of mortality began in 1861 while its publication started in 1865. (37) Birth registration, on the other hand, commenced in 1870 in the urban areas and in 1880 in the countryside. Two separate registers were maintained for recording births and deaths. Since then, the same system has been in practice in one form or the other.

The earliest inquiry into the scope and accuracy of vital registration in Pakistan was conducted by Khan (1957) who estimated that, in the Punjab Province where the registration system was comparatively better than in the country's other areas, there was 27.2 per cent underregistration of births and 53.4 per cent that of deaths during the period 1950-52. (38) In a subsequent study, Khan and Ziaud-Din (1959) estimated that during 1954, in the whole of Pakistan, the underregistration of births and deaths was 29 and 46 per cent respectively. (39)

In view of the low level of accuracy and reliability of vital statistics through the official registration system, the need was felt to develop a reliable system of vital data collection. As a result, the Population Growth Estimation

(PGE) Project was launched in 1961. This yielded estimates of vital rates in selected sample areas for the period 1962-65. In January 1968, the PGE Project was replaced by a similar experiment, the Population Growth Survey (PGS) which produced data for the years 1968, 1969 and 1971. But, although a good deal of improvement in the quality of data has been witnessed, information on the population growth rate and its components is not yet as accurate as the population analysts would wish. (40)

Numerous studies have been undertaken on various population aspects using the PGE and PGS data, all of which have pointed out a massive degree of under-registration of births and deaths in the area. This is discussed in detail in Section 3.5

A detailed review of the two methods of collecting population data serves a dual purpose; to underline the importance of population statistics in the present study; and to underscore the fact that the region has a reasonably good history in this regard. The fact is that, compared with the world as a whole or a country of similar resources, the region's past population statistics are above the average in quality and quantity and hence more usable for research. As already mentioned, the present inquiry draws substantially on the series of censuses. Thus, all census volumes particularly those on the Punjab, because of their direct relevance, have been scanned in the course of investigation.

1.6.2. Agricultural Statistics

As in population statistics, the region had a well developed system of gathering economic statistics in ancient times. There is ample evidence that throughout the subcontinent's history, particularly during the periods of stable rule like that of Chandragupta Maurya (c.322-298 BC), Asoka (c.269-232 BC), Chandragupta II(c.385-413), Harsha (606-647) and Akbar (1556-1605), the rulers resorted to collecting information about various socioeconomic attributes. (41) Even in the modern context, the subcontinent has been the subject of numerous

and voluminous reports providing,in all, a large quantity of statistical and other information. Thus there exists a considerable volume of serial economic statistics, some running well back into the nineteenth century. The Punjab, in turn, is believed to have produced the best regional literature of British India. (42) Attention in the present study, however, has been focussed mainly on the post-Independence economic statistics of Pakistan.

At the time of its inception, Pakistan inherited from British India some statistical units at the centre as well as in the provinces. However, collection and processing of statistics was not quite adequate. Realizing the inadequacy of such a base for the newly emerged developing country and recognizing the needs for new measurement of the indices of economic advancement and social welfare, the Central Statistical Office (CSO) was established in August 1949. It began functioning in August 1950. (43) Its regular publications, the monthly Statistical Bulletin (started March 1952) and Pakistan Statistical Yearbook (started 1952), in addition to numerous periodic and regular publications, are of immense value in research because of their reliable and authentic statistics. In the present study much use has been made of these publications.

The emphasis on collection and publication of development statistics continued growing with the passage of time. With the realization that accurate statistics provide the necessary foundation for the economic reforms, due weight was accorded to this aspect during the First Five Year Plan period (1955-60) and the Second Five Year Plan period (1960-65). (44) As a result, considerable progress was made in the collection and publication of statistics. In the meantime, various departments of the Provincial and Central (now Federal) Government initiated the job of data collection and publication in their respective fields. Some of these departments created special statistical cells for this purpose. In addition, a number of autonomous and semi-government bodies, especially in the fields of agriculture, water and power and industries, started bringing out their regular and periodic publications. Pakistan's first agricultural census was held in 1960, followed by the second in 1972. On both

occasions detailed agricultural statistics were published which have been of great use in this study.

At the provincial level in the Punjab, invaluable work has been done by the Punjab Board of Economic Inquiry (established 1919) and the Bureau of Statistics. These two bodies collect and publish fairly reliable data about various aspects of the Province's economic development, with a special emphasis on agriculture.

An attempt has been made to exploit, to the greatest possible extent, as many of these publications as were relevant. Adjusted figures for the pre-Partition period have also been obtained from these sources. The data for the period 1955-70, when the Punjab did not function as a province because of its merger into the then West Pakistan's "One Unit", have been compiled from the statistics of the Punjab's districts.

1.7. METHODOLOGY AND ORGANIZATION OF THE STUDY

The empirical basis for the present study is the experience of the Punjab as a whole and its constituent administrative divisions and districts for which population and agricultural data are available. As mentioned earlier, the inquiry has been conducted in the wider context of Pakistan for the post-Independence period and in the geo-historical setting of the Indo-Pakistan subcontinent for the pre-Independence years. The study, therefore, starts on a "macro" scale but much of the analysis has been done at a "meso" level, though an attempt has also been made to conduct the inquiry and deduce results, wherever possible, at a "micro" level.

The study is organized into seven Chapters. In Chapter I, the background and objectives of the study are laid down. A description of the hierarchy of areal units is given which provides an understanding of the levels of resolution. Since the study draws substantially upon official statistics, different data sources are reviewed.

In order to develop an understanding of the "personality" of the study area and also to underscore its agricultural potential, the salient characteristics of its land forms and land use alongwith the exploitation of its most important natural resource - water - are comprehensively discussed in Chapter II. Thus, in addition to the Province's location, size and relief, its drainage and climate - since they provide a good deal of inducement for the irrigation development and thus a basis for the region's economic development via agriculture - are dealt with in detail.

Chapter III focusses on evolution of population. A succinct account of population change in the past as well as its future trends is given. Analysis of population growth for the period 1951-72 is carried down to the tehsil level. Components of population change are discussed in order to analyze the natural growth of population. Besides, an attempt is made to evaluate the urban-rural differential of population growth, underscoring the significance and role of urbanization in the internal movement of population and subsequently in the spatial patterns of population change. Finally, in order to compare the Province's population growth rate with those of its constituent parts and also to sum up urban-rural differences in one model, a typology of population change is evolved.

Chapter IV deals with distribution of population in the region. Comparisons are drawn up with the equal sized countries and regions. Factors influencing population distribution in the area and their relationships with the spatial patterns are discussed in detail. In addition, the changes in the areal patterning of population distribution with respect to time are studied and analyzed for the period 1901-72.

Chapter V contains a detailed account of agricultural change in the area. It opens with a review of Pakistan's economy and the role of agriculture in the country's economic progress with a special emphasis on the part played by the Punjab in the nation's agricultural production. The question of agricultural development being multidimensional, an attempt is made at first to analyze the

changes that have taken place in the spatial patterns of land utilization and productivity in the Punjab after Independence. Irrigation, being a very important input, has received due consideration, besides other forces of change. Secondly, an attempt is made, as far as data permitted, to analyze the labour productivity and the social and institutional side of agricultural development.

Chapter VI studies the interrelations between population growth and agricultural change in the region. It opens with a comprehensive review of the related concepts. An obvious outcome of population growth is the growth of agricultural labour force which has, in turn, far reaching effects on agricultural inputs and outputs. Attention is, therefore, focussed on the changes brought about by the growth of agricultural labour force. Then, with a view to disentangling these interrelations and to defining their nature and intensity in a regional context, the changes in the two sets of variables - population and agriculture - are collated through a correlation analysis. Finally, the last chapter, which forms the overall conclusion of the study, presents the findings of the preceding chapters in a succinct and coherent form.

In order to process the large amount of population and agricultural data, extensive use was made of NUMAC (Northumbrian Universities Multiple Access Computer) through the University of Durham Computer Unit. To work out various rates and ratios, Fortran was used; whereas for correlations and scatter diagrams, recourse was made to MIDAS (Michigan Interactive Data Analysis System). The great majority of maps and diagrams were drawn manually but most of the choropleth maps were prepared on the computer by using the "GIMMS" Package. In almost all choropleth mapping, quintile intervals have been adopted for districts and octile intervals at the tehsil level.

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6. Ibid, 1-40
   (The figures are five-year averages for 1970-1/1974-5)
7. Ibid, 149-150
8. Punjab Development Review and Prospects 1976, 123
9. Zaidi, 1970, 45
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11. Population Census of Pakistan 1961
12. Law, 1914, 106-116
    Smith, 1924, 134
13. Megasthenes,106
14. Law, 1914, 107-110
15. Maclagan, 1892,4
16. Risley, 1901, xiii
17. Ibbetson, 1883, 12
18. Cushing, 1915, 144
19. Hutton, 1932, 82
20. Shirras, 1935, 434
21. Khan, 1933, iv
22. Until 1931, large census schedules were used in which the enumerators entered all information conveyed to them by the respondents. During tabulation, the first stage involved the transfer of information from schedules to slips which then underwent the process of sorting. This method increased the expense of time and money and also enhanced the scope of error and omission. The 1941 enumeration was conducted straight on slips.
23. Yeatts, 1943, 15
24. For example Cushing, 1915 and Shirras, 1935
25. For instance Sir William W. Hunter, Sir George Grierson, Sir Herbert Risley.
    see : Davis, 1951, 5
26. Davis, 1951, 243
27. Shamsi, 1957, 3
28. Slade,n.d., 1
29. Ibid, 2

30. Some examples are :

    Krotki and Hashmi, 1962, 377

    Krotki, 1963, 279

    Sanaullah, 1962, 106

31. Krotki, 1963, 279

32. In 1961, the enumeration schedule contained as many as 22 questions

33. Afzal, 1973, 123

34. Bean, 1974, 177

35. Chandrasekhar, 1972, 40

36. Available record reveals that the registration of births and deaths was initiated in 1844 in Madras, in 1848 in Bombay, in 1870 in Bengal and during the period 1870-80 in most other places that came under the control of British Indian Government. See : Ibid, 41

37. Registration began under the orders of the Inspector General of Police under Section 12 of the Police Act, 1861. Publication started in "the Annual Report of Inspector General of Dispensaries, Punjab for the year 1865"

38. Khan, 1957, 1

39. Khan and Ziauddin, 1959, 414

40. Chaudhry, 1973, (Foreword)

41. Law, 1914, 106-116

    Nath, 1929

    Basham, 1967

    Smith, 1931, 168-189

42. Spate and Learmonth, 1967, 532

43. Recently it has been upgraded as the Statistics Division

44. The First Five Year Plan 1955-60, 123-127

    The Second Five Year Plan 1960-65, 121-123

CHAPTER II

LAND-WATER-AGRICULTURAL POTENTIAL

2.1. GENERAL

The uneven distribution of population in any region is the product of a host of interacting factors which range from natural elements such as relief, climate, soil and vegetation, through socio-cultural determinants to the type and scale of economic activities. Thus a balanced geo-demographic study of an area requires a discussion of the "personality" of that area in terms of its physical and human geography. The need is to take stock of the multitude of physical, economic, demographic and numerous other aspects, not in isolation but as interrelated influences upon population distribution.(1)

This chapter presents a resumé of the "personality" of the Punjab in terms of its landforms, climate, water resources and agricultural potential. The objective is not to drive a wedge between the physical and the human geography of the region, nor to enter the controversial debate regarding the legitimacy of the role of diverse sets of factors like the natural and man-made features; it is rather to provide a background for the analysis of population distribution as well as for the explanation of the spatial patterns of population change vis-a-vis agricultural change.

It may be borne in mind that, although the environment has seemingly a considerable bearing upon man's activities, it is exceedingly difficult to make a reasoned assessment of population distribution or human activities in terms of any single element of the environmental complex. This is so because the mixture of elements that make up the totality of the non-human, physical environment is complex, making it exceptionally difficult to formulate a logical and satisfactory statistical index which could express the intrinsic population-carrying capacity or any other value of demographic significance for an area.(2) The purpose of this chapter, therefore, is to provide a foundation for the main body of the present inquiry.

2.2. SIZE AND LOCATION

Extending from 23.50 to 36.75°N. latitude and from 61 to 75.50°E. longitude, Pakistan lies along the eastern border of the Middle East but outside that region. Lying adjacent to the two "population giants" of China and India to the east and adjoining rather sparsely peopled Iran and Afghanistan on the west (Fig. 2.1(a)), it occupies the westernmost quarter of the single most populous zone of the world, "the underbelly of Asia". (3)

The area of Pakistan excluding the disputed territories of Jammu, Kashmir, Junagadh and Manavadar, the final status of which is yet to be determined, also excluding the remote frontier agencies, Gilgit and Baltistan, is 796,095 sq.km. (307,374 sq.miles). (4) Transitional in many ways between the Middle East and India, Pakistan is almost half the size of Iran and a little less than one quarter that of the neighbouring India.

The Punjab, the northeastern province of Pakistan, the "Pentapotamia" of the Greek historians, derives its name from the two Persian words, Punj (five) and ab (water), since it is traversed by the Indus and its four eastern or left bank tributaries, the Jhelum, Chenab, Ravi and Sutlej, to name them in order from northwest to southeast. The origin of the name can perhaps be traced to Panca Nadia, Sanskirit for "five rivers". (5)

Extending from latitude 27.70 to 34.03°N. and from longitude 69.33 to 75.38°E. and roughly equal to the combined size of England and Scotland, the Punjab covers an area of 205,345 sq.km. (79,284 sq. miles) and thus, with about a quarter of the national territory, ranks second after Baluchistan, amongst Pakistan's four provinces. Smaller than the old Punjab Province of British India, which was divided between Pakistan and India in 1947, it now includes the erstwhile Bahawalpur State and is four times the size of the present Indian state of Punjab.

Almost quadrilateral in shape with a width of 300-350 km. from east to west and 650-725 km. from north to south, the Punjab is bounded on the north

by the Himalayan ranges which separate it from the disputed territory of Jammu and Kashmir and on the east by India, with which it has a long common border. On the west lie the trans-Indus, North West Frontier Province and the Sulaiman Range which separates the Punjab from Baluchistan. The southern margin of the Punjab is bounded by the Thar and Sind deserts occupied by the Indian state of Rajasthan and Pakistan's fourth province, Sind respectively; the latter providing a maritime outlet to the land-locked Punjab.

Almost two thirds (65.1 per cent) of the Punjab is enclosed within the Indus on the west and the Sutlej on the east; 12.7 per cent of the Province's area, comprising Dera Ghazi Khan district and Isakhel tehsil of the Mianwali district, lies in the trans-Indus zone whereas about 22.2 per cent is trans-Sutlej, comprising the former Bahawalpur State which was merged in the Punjab in 1970, on the dismemberment of West Pakistan's "One Unit." The trans-Sutlej now constitutes the Bahawalpur division.

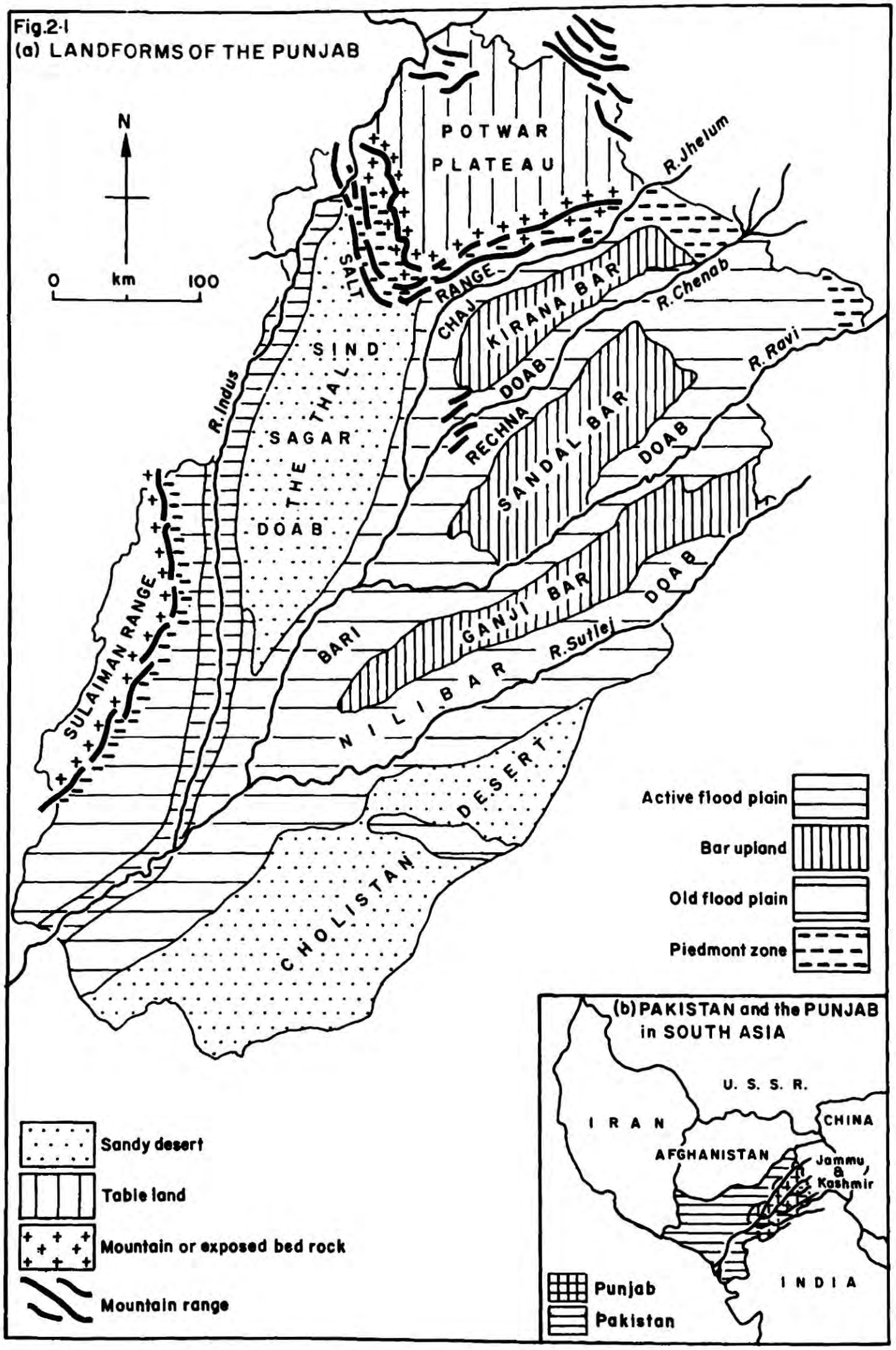
2.3. RELIEF

A large part of the Punjab comprises an almost level plain. A gift of the Indus and its eastern tributaries and overlooked by the mountainous rim in the north and the west, this broad alluvial plain is divided by these rivers into several interfluves called doabs. The general gradient of the land is low and, from the northeast to the southwest; each of the four tributaries successively joins the one to its south before all combine to flow into the Indus (Fig. 2.1(b)).

2.3.1. The Highland Segment

The Province's non-alluvial parts are mainly in the extreme north, northwest and west. In the extreme north, there is a narrow strip adjoining the Sub-Himalayan (Siwaliks) and the Lesser Himalayan ranges into which run a number of spurs of these ranges, including the Murree Hills (2,135 m.). The geological age of these hills has been estimated to extend from the Middle Miocene to the Middle Pleistocene. (6) Subjected to enormous pressure due

Fig.2-I
(a) LANDFORMS OF THE PUNJAB



to stress and strain during the Alpine orogenic period, and faulted in many parts, they merge on the west into the dissected Potwar upland, the southern margin of which is bordered by the Salt Range.

Largely barren and deeply eroded by seasonal streams, the Potwar Plateau (area : 18,130 sq.km.) (7) is made up of folded sedimentary rocks laid down close to the base of the Himalayas proper. Bounded on the east by the Jhelum, on the west by the Indus, on the north by the Kala Chitta Range and the Margalla Hills and on the south by the Salt Range, the Potwar (height : 300-600 m. ASL) has a generally northeast to southwest gradient except in its southeastern part.

Generally an open undulating country and punctuated by troughs and basins, the surface of the Potwar is sharply incised by deep ravines in the soft Siwalik beds. Scattered moraines and erratic blocks are evidence of the last glacial period and bear testimony to the existence of glacial conditions in the Himalayas. (8) The soils are often sandy and the deep-set streams not only cause vertical erosion but also render irrigation almost impossible. Thus agriculture is entirely barani (rain-fed). However, the region has a geological structure quite favourable for oil, believed to have migrated from the underlying Eocene. (9) A large part of the plateau, deeply dissected and eroded by the deep-set streams, is a typical "bad land" area.

Bordering the Potwar Plateau on its southern ridge, lies the Salt Range. This is a continuous range of low flat-topped mountains running in an approximately east-west direction from longitude 71 to 74°E. The range starts in the east near the Jhelum in the Joggi Tilla and Bakralla ridges and runs almost parallel to the Jhelum's right bank before turning northwest to make deep bends before and after crossing the Indus near Kalabagh. With barren cliffs and dried gullies, and representing a complete geological sequence from Cambrian to Tertiary, it is of great geological and stratigraphical interest and has been referred to as "a field museum of geology". (10) Located in both

the cis-Indus and the trans-Indus zones, and lying barely 80 km. south of the northwestern portion of the Himalayas, the Salt Range offers striking contrast to the latter.

The average elevation of the range is about 670 m., but near Sakesar it rises to about 1500 m. Comprising parallel ranges of low flat-topped hills, it encloses small fertile intermontane valleys, basin plains and plateaux such as Malot, Nurpur, Dandot, and Sakesar, and is punctuated by numerous saline lakes such as Khabeki, Kallar Kahar and Achhali.

Faulted in a most characteristic fashion throughout its length of 245 km., a conspicuous feature of the range is that its more or less level plateau top ends abruptly towards the south, making a remarkable, some 600 m. high, steep face dissected into jagged spurs and crests and separated by wild ravines, while northward its gradient is low and it merges gently into the Potwar.

The area possesses great mineral wealth and, in addition to gypsum and coal, enormous deposits of rock salt, probably the biggest in the world, are worked at numerous points. Besides mining, which forms the major activity, some agriculture is practised in the small intermontane basins.

2.3.2. The Punjab Plain

The northern and northwestern mountainous and the submontane zones of the Punjab comprising the Himalayan ranges, the Potwar Plateau and the Salt Range cover nearly 11 per cent of the provincial area. The rest of the Punjab is a flat tract of land known as the Upper Indus Plain which occupies the northern part of the extensive alluvial plain stretching from the foot of the Himalayas to the Arabian Sea. On the northwest its limit is marked by the ramparts of the Salt Range, while towards the south it continues beyond the Punjab's politico-administrative boundary into Sind, where it merges into the Lower Indus Plain. The Upper and the Lower Indus Plains are easily

distinguishable from each other since the latter has a gentler slope and is devoid of major interfluves because the Indus, having received the waters of all its tributaries well inside the territory of the Punjab, becomes rather sluggish and is a lone river meandering through its wide braided channel.

The Upper Indus Plain (183,089 sq.km.), a massive alluvial plain - some 565 km. northwest/southeast by 725 km. northeast/southwest - encompasses the Sargodha, Lahore, Multan and Bahawalpur divisions together with the Gujrat district of Rawalpindi division. Its remarkably uniform topography makes it one of the most homogeneous physiographic regions on earth. (11)

The surface of this vast, smoothly rolling plain is formed by the alluvium brought down from the Western Himalayas by the Indus and its tributaries. The alluvial material is of great thickness which has not yet been precisely ascertained but may measure as much as 4500 m. near its northern edge as calculated by Oldham. (12) It is considerably less in the south.

The relief of the plain is low and the gradient gentle. Almost the entire plain lies below 370 m., most of it less than 180 m. above sea level and, although the elevation exceeds 370 m. in a tiny strip in the north, it falls below 75 m. in the extreme southwest. The gradient is steepest in the northern submontane strip where it is 1:350 while in most other places the slope is gradual, about 1:5,000 and in the extreme southwest it is the lowest - 1:10,000.

The rivers have divided the land surface into four parallel and longitudinal rather oblong tracts, the interfluves or <u>doabs</u> whose names are acronyms compounded from the names of their confining rivers. They are, in order from the west : Sind Sagar (35,405 sq.km.) between the Indus and the Jhelum; Jech or Chaj (13,900) confined by the Jhelum and the Chenab; Rechna (31,300) enclosed by the Chenab and the Ravi; and the Bari (30,800) lying between the Beas-Sutlej and the Ravi. All these <u>doabs</u> are similar in

topography except for some minor differences in the micro-relief and were virtually barren deserts or semi-deserts before the advent of large scale irrigation at the end of the nineteenth century, as a result of which the desert waste was converted into useful cropland. Large scale irrigation development having been the focus of attention throughout the twentieth century, the conversion of the desert waste to cultivable cropland is still in progress. In the post-Independence period, for example, a large part of the largest of the doabs, the Sind Sagar (also called Thal) has been reclaimed and more is in the process of reclamation.

The meandering rivers have, by way of their erosive work, carved broad, open valleys. The active flood plain of the river - the bet or khaddar is inundated in almost every flood season during summer or late summer. Large scale erosion and deposition going on, these bets are the scene of changing river courses and are characterized by the youngest, coarse textured and thinly stratified alluvium.

The high river banks are frequently capped by aeolian deposits. In the doabs, the land generally rises gradually from the bets through the old flood plains and culminates in the elevated plains in the centre of each doab. Consisting mainly of old alluvium and signifying the oldest level of deposition by the present drainage system, they are called scalloped interfluves or bars. These are separated from the old flood plains by river-cut escarpments which often exceed six metres in height. In the Sahiwal and Multan districts of the Bari Doab, the elevated part between the Sutlej and the old course of the Beas is called Nili Bar and that between the old channel of the Beas and the Ravi is known as the Ganji Bar. Similarly Sandal Bar is the raised platform in the middle of the Rechna Doab while Kirana Bar is located in the Chaj or Jech Doab. All these bar tracts were, before the advent of modern irrigation, desolate and dreary wastelands. Characterized by a bare, hard and almost impervious surface

and dotted with small hardy trees or shrubs which tended to collect the moving sand and dust to form sandy hills, these tracts bore a great resemblance to the Sahara. (13) However, as already indicated, this barren desert landscape has been profoundly altered with the introduction of large scale irrigation. Nevertheless a large part of the Sind Sagar Doab (the Thal) still has desert or semi-desert conditions characterized by narrow belts of level land between the sandy hills. This area is in the process of rapid reclamation with the construction of canals. Closely resembling this is another wasteland in the southeast where the Thar Desert extends into the Bahawalpur division and occupies most of the southern part throughout its northeast/southwest length. This consists largely of sand dunes and sand ridges, occasionally rising over 150 m. above the surface, and contains some scattered salt lakes. Known as Rohi or Cholistan, it is separated from the central irrigated strip of the plain by the Hakra depression, which is about 5 km. wide and is, in fact, the dry bed of an extinct river, the Ghaggar.

At present, Cholistan is a barren, desolate area with a thin, scrubby vegetation, but numerous plans for its reclamation and subsequent development are under active consideration by the Government of Pakistan and a number of schemes have already been formulated and are awaiting implementation. (14) Most of these schemes aim at making this a flourishing agricultural region by providing water for irrigation, and will inevitably help in reshaping the face of the land.

The rest of the trans-Sutlej Bahawalpur division is a riverine tract, quite similar to the doabs. Geologically a part of the Thar Desert, it has been reclaimed through the development of irrigation.

A strip of the trans-Indus district of Dera Ghazi Khan (total district area : 24,240 sq.km.) lies on the Sulaiman piedmont. The Sulaiman Range lying close by, this strip runs in a north-south direction all along the

length of the district and is structurally a part of the zone known as Derajat. It greatly resembles the Himalayan piedmont on the northern margin of the Upper Indus Plain, and is characterized by numerous streams and torrents running at a relatively steeper slope.

It is apparent from the above discussion that the Upper Indus Plain, occupying almost 89 per cent of the Punjab, is a homogeneous zone with a markedly uniform topography. The alluvial monotony is, however, slightly disturbed by the low, dry and broken hills on both sides of the Chenab near Sangla and Kirana. These isolated hills,which at some points rise more than 300 m. above the plains, are believed to be small straggling outliers of the Aravallis of the Indian peninsula. (15) Small in extent, and lying within 65 km. of the Salt Range, these deeply weathered hills are regarded as the projections of a subterranean ridge which extends from Delhi northwestward to the Jhelum end of the Salt Range. Detected through gravimetry and sometimes called the "Shahpur-Delhi Ridge", this feature acts as a sub-surface dam and divides the plains into two subterranean water basins, of which the northeastern, because of its upstream location, holds most of the sub-soil water. (16) Extending nearly 100 km. from northwest to southeast, these hills are devoid of any agriculture.

2.4. DRAINAGE

The most striking feature of the Punjab's topography is offered by its rivers. Comprising the Indus and its tributaries, together constituting what is called the Indus system, they not only confer a distinctive physical character on the area but also provide its life-blood. The Province's agricultural prosperity, which serves as the foundation for its economy, owes a great deal to these rivers. Rainfall being scanty and erratic, these rivers have proved to be an invaluable resource for the development of an efficient irrigation system which has, in turn, played a vital role in the conversion of uninhabited, desert wasteland into an area of flourishing agriculture.

The Indus, sometimes likened to the Nile [17], has a large number of affluents but, with the exception of the Kabul, the only important right bank or western tributary, all the major affluents are from the east. These are : the Jhelum Chenab, Ravi and Beas-Sutlej. All these rivers have their sources and upper courses in the eternally snow-clad Himalayan ranges flowing from where at varying degrees of steepness for long distances, they descend into the plains. They then flow through a region of meagre precipitation and high summer temperatures, on a low northeast to southwest gradient forming braided channels; each tributary successively joining the one to its south, until all combine to empty into the Indus (Fig.2.1 (b)). The major source of water supply in these rivers is, therefore, the precipitation in their mountainous catchment areas, the contribution to river flow made by precipitation in the plains being very small.

With a mean annual flow of 217.1 thousand million m^3 at the rim stations [18], the Indus and its affluents constitute one of the world's principal river systems, almost equal in the volume of flow to the Columbia river system of the United States and Canada and more than three times as large as the Nile.

The Indus, the principal river of the system, rises behind the great mountain wall of the ice-covered Himalayas in the region overlooking the Mansarovar in the vicinity of Kailas, and follows a long tortuous course around the lofty Karakorams, maintaining a southeast to northwest direction. It then turns southward before entering the Attock-Kalabagh gorge. Out of its 2900 km. long course, approximately 1100 km. is in the mountains. Its catchment area is estimated at about 269,000 sq.km. - twice as large as those of all its tributaries combined (Table 2.1). The mean annual discharge of the Indus (with the Kabul) is 114.7 thousand million m^3 - 53 per cent of the system as a whole.

Emerging from the 160 km. long Attock-Kalabagh gorge (400-200 m.ASL),

TABLE 2.1 HYDROLOGICAL DATA OF THE INDUS RIVERS

River	Catchment Area 000 km^2	Mean Annual Rainfall in catchment area (mm)	% of Rainfall Run off	Average Annual Discharge	
				Gauging Station	000 mill m^3
Indus	268.8	450	78.0	Kalabagh	114.7
Jhelum	33.4	1075	84.9	Mangla	28.4
Chenab	29.5	1200	81.0	Marala	32.1
Ravi	8.0	1000	40.9	Madhopur	8.6
Beas	12.6	1435	77.3	Pong	16.0
Sutlej	48.0	500	56.7	Rupar	17.3

SOURCES : 1. Ahmad (1965)

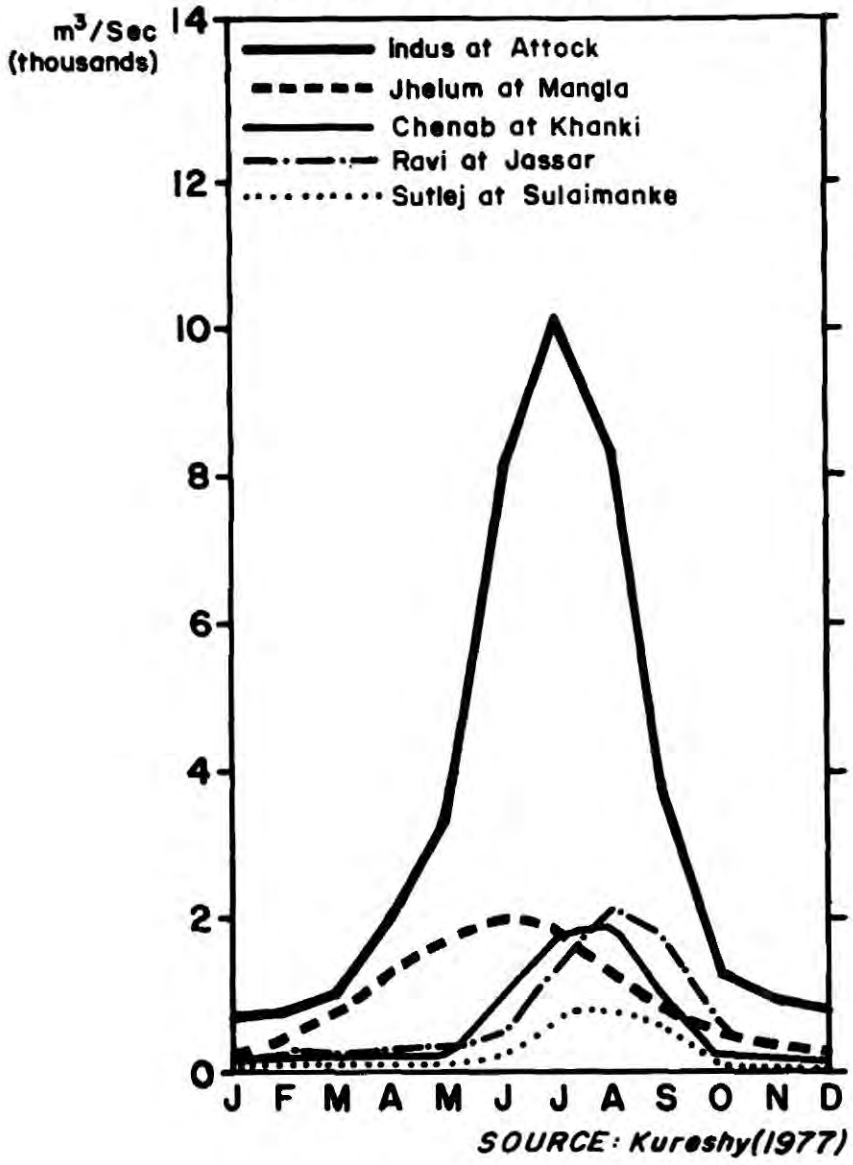
2. Michel (1967)

the Indus expands into a wide channel which is divided into numerous parts during the winter months. These lesser channels are separated by sandy islands but merge into a single broad channel during the period of spate. Flowing on a near level plain [19], the Indus now signifies a typical lowland river characterized by low velocity, meandering course and abandoned channels. In places its bed is 20-25 km. across. About 1,000 km. before its termination in the Arabian Sea, the Indus receives the combined waters of its eastern affluents. All the Punjab rivers are similar to the Indus in having their sources in the Himalayan ranges, carving broad valleys after issuing from the mountains, meandering widely and in flowing across the plains in ill-defined and everchanging channels.

The volume of water in these rivers shows a great deal of seasonal variation. Each has its individual flow characteristics with irregular regimes but they all start rising in spring with the snow melt and attain a climactic stage in July or August when the snow melt is augmented by the monsoon rains. Minimum discharges, on the other hand, are experienced during the winter months. The volume of water in the rivers during early summer varies with their size, altitude, position with respect to monsoons, the height of the snow line and heritage of glaciers from past eras in the respective catchment areas. [20]

Figure 2.2 shows the monthly river discharges at various stations in the Punjab and depicts the seasonal fluctuations in the rivers' runoff in any year. As is clear, the volume of water in the three western rivers begins to rise with the snow melt in late February or early March. This increase is experienced significantly later in the three eastern rivers : by the end of April in the Ravi and towards mid-May in the Sutlej. With the approach of summer, all the rivers swell and their flow is greatly enhanced by the monsoons during July and August. It is not uncommon to find the normal summer runoff 50 to 100 times larger than the winter minimum. This causes great problems of flood control and water management. The area is

Fig. 2·2
REGIMES OF THE INDUS RIVERS IN THE PUNJAB



SOURCE: Kureshy(1977)

known to have experienced numerous floods of calamitous proportions with an immense loss of crops, property and life. The rivers start receding at the end of the rainy season. The decrease in volume of water begins in early September in the Indus and Jhelum but almost a month later in the other rivers, depending on the behaviour of the monsoons. However, some of the worst floods have been experienced in late September or even in October. The decline in flow after the peak stage is generally sharper than the rise before it.

The pronounced periodicity of river regimes does not comply well with the region's cropping seasons. Khosla (1958) estimated that, during the six months of April to September, the rivers carry 84 per cent of their total annual flow, of which 54 per cent is concentrated in the rainy season (July to September). During winter (October to March), on the other hand, they carry only 16 per cent of their annual supply. (21) Thus water flow during the rabi (winter) cropping season is abysmally low, while that during the kharif (summer) season is greatly in excess of the requirements of agriculture and a large quantity of water goes unused. In order to maintain a balance, therefore, there is an urgent need to regulate the flow by building dams and reservoirs.

2.5. CLIMATIC AND WEATHER CONDITIONS

Extending from 27.70 to 34.03°N and situated between 500 and 1200 km. from the Arabian Sea on the northern margins of the Thar Desert, the land-locked Punjab has a climate that has all the ingredients of continentality with a pronounced degree of aridity and marked ranges of temperatures both diurnal and seasonal. Except in the north, where altitude exerts an ameliorating influence upon temperatures, the summers are hot. Winters in all parts of the Province are cold with plentiful snow in the highland. During much of May and June, the day temperatures at most places in the Upper Indus Plain exceed 40°C, occasionally soaring to 45-48°C by mid-June, whereas the mercury drops during some January nights to freezing point, particularly

in the north. The small submontane segment in the north, with lower temperatures and higher precipitation, stands in sharp contrast to the dominant plain area. The mean annual temperature increases from 21 in the north to over 26°C in the south. The mean annual range of temperatures at Lahore in the middle of the Province, exceeds 22°C. The annual precipitation, with a marked summer maximum, is generally below 900 mm. and less than 100 mm. in the extreme southwest of the Province. Rainfall is not only inadequate for plant growth but is also highly variable from year to year in amount as well as in timing. Due to high temperature and excessive evaporation, the region's evapotranspiration is universally in excess of the monthly and annual rainfall, and this imbalance is exacerbated during the long summer days. Table 2.2 shows the temperature and precipitation data for eleven selected stations, arranged from north to south and Figure 2.3 depicts a general distribution of these climatic variables in the Province.

Situated in the northwestern extremity of the subcontinent's monsoon belt, the Punjab comes under the sway of these winds later than most other parts of the subcontinent, at a stage when their intensity has considerably diminished. Thus, despite being an essential part of the subcontinent's monsoon system, the Punjab's pattern of temperature and precipitation is quite distinct from that experienced in the east and southeast of the subcontinent. The climate of a large part of the Punjab, on the basis of Köppen's classification, is tropical arid in contrast to the cold semi-arid or steppe type experienced in the northern submontane strip. According to Thornthwaite's classification, the two parts of the Province fall in the arid mesothermal and semi-arid mesothermal categories respectively. Taking into account the local physiography, Ahmad (1951) attempted a classification of Pakistan's climates, according to which the Punjab Plain experiences a sub-tropical continental lowland type of climate characterized by high summer temperature and late summer rains, whereas the climate of the northern submontane region is sub-tropical continental highland with cold snowy winters and higher

TABLE 2.2

CLIMATOLOGICAL DATA FOR SELECTED STATIONS IN THE PUNJAB

(40-Years Averages)

Station		J	F	M	A	M	J	J	A	S	O	N	D	Annual
Murree 33.88°N 73.42°E	M	6.3	8.1	12.0	18.0	23.3	26.1	23.5	22.2	21.9	19.0	14.7	9.7	17.0
	N	-0.6	0.7	4.3	9.0	13.5	16.2	16.0	15.3	13.2	9.4	5.5	1.9	8.7
	P	119.4	111.8	154.9	101.6	61.0	106.7	360.7	358.1	134.6	53.3	20.3	53.5	1,635.7
Campbellpur 33.72°N 72.37°E	M	16.4	19.8	23.6	29.5	36.2	40.8	37.8	36.4	35.3	31.4	24.1	18.2	29.1
	N	2.2	5.2	10.8	15.3	20.9	26.2	26.7	25.9	22.8	14.3	7.3	3.3	15.0
	P	53.3	33.0	55.9	48.3	27.9	17.8	127.0	104.1	48.3	17.8	12.7	55.9	602.0
Sialkot 32.45°N 74.53°E	M	18.4	21.4	26.8	33.9	39.5	40.8	35.7	33.9	34.6	32.7	26.8	20.4	30.4
	N	5.7	8.4	13.1	19.0	24.6	27.1	26.4	25.6	24.0	17.1	9.8	6.4	17.3
	P	45.7	40.6	40.6	20.3	12.7	55.9	266.7	246.4	96.5	20.3	7.6	20.3	873.6
Sargodha 32.07°N 72.67°E	M	19.7	22.5	27.3	32.1	37.5	41.8	37.9	36.3	36.2	33.1	27.0	21.5	31.1
	N	3.2	7.4	12.5	17.1	21.3	26.8	27.5	26.5	23.6	16.5	9.2	1.4	16.1
	P	20.3	15.5	25.4	22.9	22.9	17.8	104.1	83.8	22.9	7.6	5.1	17.8	366.1
Lahore 31.55°N 74.33°E	M	19.3	22.4	27.9	34.8	40.3	41.1	37.1	35.9	36.0	33.6	27.9	21.9	31.5
	N	5.1	8.1	13.1	18.4	23.7	26.8	27.2	26.5	24.1	17.3	9.5	5.7	16.7
	P	30.5	22.9	22.9	15.5	7.6	38.1	121.9	121.9	78.7	10.2	2.6	10.2	483.0
Multan 30.15°N 71.48°E	M	20.0	26.3	29.0	35.9	40.8	43.1	39.5	38.5	37.5	34.3	27.8	22.1	32.9
	N	4.6	7.6	14.1	19.1	23.7	29.0	28.8	28.2	25.7	18.0	10.3	6.0	17.9
	P	10.2	7.6	20.3	10.2	12.7	5.1	33.0	30.5	22.9	0.0	2.6	12.7	167.8
Rahimyar Khan 28.40°N 70.30°E	M	21.7	24.8	28.7	35.3	42.4	43.1	39.2	39.4	38.9	35.9	35.3	23.4	34.0
	N	6.8	9.6	12.0	16.8	22.7	28.4	28.3	28.3	24.5	16.6	8.4	6.7	17.4
	P	5.1	5.1	10.2	5.1	2.6	5.1	40.6	33.0	7.6	0.0	0.0	2.6	117.0

M = Mean Max.Temp.(°C) N = Mean Min.Temp.(°C) P = Precipitation (mm)

SOURCES : converted from 1. Ahmad (1972) 2. Kureshy (1977)

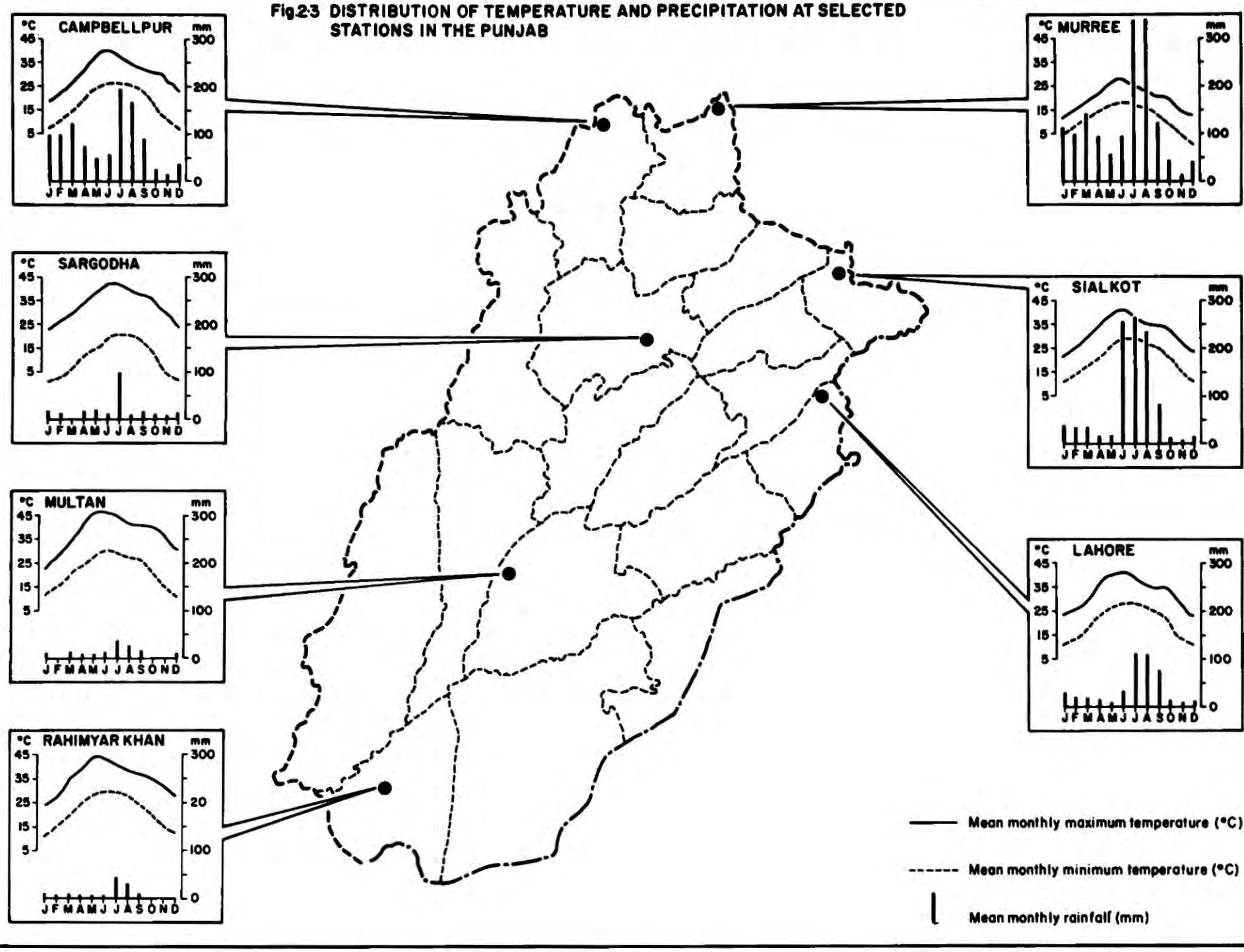
winter and spring rains. (22) These classifications provide a useful insight into the general climatic conditions of the area especially with respect to the distributional pattern of temperature and precipitation. A detailed picture is however provided by an appraisal of the Province's general weather conditions experienced in any year.

The Punjab, like the rest of the subcontinent, experiences four distinct seasons but with a slight difference in their duration. The four seasons are : Cold Weather (mid-December to March), Hot Weather (April to June), Monsoon (July to September) and Post-Monsoon (October to mid-December). Following is a brief description of the general weather conditions during these seasons. (23)

The Cold Weather season characterized by fine weather, low humidity and high diurnal temperature range,commences in mid-December when high pressure sets in over Central Asia and the Middle East. Mean January temperature varies from 10°C at Rawalpindi to 12.5 at Lahore and 14.5 at Rahimyar Khan and pressure remains generally high, exceeding 1013 mb at most places. The generally fine conditions are upset by the low pressure western disturbances moving in from the Mediterranean via the Middle East. (24) Extra-tropical in nature, these disturbances occasionally have well marked warm and cold fronts whose frequency and intensity increases with the progress of winter. They cause the winter rainfall which, although small in amount, is vital for the rabi (winter) crops. The amount of winter rains varies from 198 mm. at Campbellpur in the north to 23 mm. at Rahimyar Khan in the south. The mountains in the north of the Province, however, receive most of their winter precipitation in the form of snow, which is of great significance since its thaw becomes the major source of river supply during the following summer.

The western disturbances sometimes bring in their wake cold waves which cause a sharp drop in the mercury over a large part of the Province.

Fig.2·3 DISTRIBUTION OF TEMPERATURE AND PRECIPITATION AT SELECTED STATIONS IN THE PUNJAB



During the period of such cold waves, sub-zero temperatures have been experienced at most places : -1.7°C at Lahore, -4 at Rawalpindi and -11 at Murree.

The Hot Weather season is characterized by high temperature, low pressure and widespread aridity. With the approach of April, temperature begins to rise and a sharp decline in pressure takes place. As a result, a trough of low pressure begins to form over the region and a large part of the Punjab experiences a pressure below 1000 mb, with the mean temperature ranging between 22 and 28°C. Relative humidity declines from 50 per cent in the early morning to less than 25 in the afternoon and at some places it may fall below 20 per cent. The total rainfall during the three "pre-monsoon" months varies between 25 and 75 mm. in most places. The western disturbances, which are the major source of this slight precipitation, are pushed northward and bring widespread dust storms over the plains and thunderstorms in the hilly areas. Occasional cold waves and hailstorms during April have harmful effects on the crops.

During May-June, temperatures touch their peak; over large areas the mean maximum daily temperature varies between 41 and 46°C, while thermometer readings of 48 or over are not uncommon. Once again, owing to the north-south extension of the Province and also because of the altitudinal differences, the south experiences higher temperatures. In Rawalpindi, the mean June temperature is 32°C while at Rahimyar Khan it is 36° but the striking characteristic of the hot weather is perhaps not so much the absolute temperature level as the continuity of high temperatures. The excessive, unabated direct insolation causes widespread dry and sultry conditions. At some places, the night temperatures exceed 32°C while, during a large part of the day, the loo (hot wind) blows with varying intensity in every part of the Province,except in the northern montane strip, to make conditions very oppressive and inhospitable.

A recent phenomenon observed during the last decade or so, is the suspension over the length and breadth of the Province, of a thick blanket

of dust from the end of May until the arrival of the Monsoon. Although it is widely believed to have been blown up from the neighbouring Rajasthan Desert, the precise nature of its origin, duration and extent is not known owing to the lack of scientific studies.

A respite from the sweltering summer conditions is brought about by the monsoons which arrive in the Punjab to herald the period of summer rains at the end of June, later than in other parts of the subcontinent. The development of low pressure over the subcontinent's blazing interior draws the winds from the Arabian Sea and the Bay of Bengal which, crossing over different parts of the subcontinent in different directions, meet in the intertropical convergence zone (ITF). The position of the ITF oscillates over the northeastern part of the subcontinent and a number of tropical depressions and storms originate from it in the Bay of Bengal and move northwestward. After having traversed a long distance, they enter the Punjab usually in the form of thunderstorms and cause heavy downpours. The total amount of rainfall caused by these storms in the Province is, however, meagre since they have released a large part of their moisture in other parts of the subcontinent, particularly in the lower elevations of the eastern Himalayas. Nonetheless, they bring about an overwhelming proportion of the Punjab's annual precipitation ranging between 60 and 80 per cent at different stations. Monsoon rainfall is greatly influenced by the relief and the relative location of the station and decreases from north and northeast to south and southwest. At Rawalpindi in the north, the total precipitation during July, August and September is 571 mm.– 60 per cent of the annual precipitation at that station; while Rahimyar Khan in the south receives about 80 mm. during these three months – almost 70 per cent of its annual total. Thus, although the amount of precipitation in any one season varies considerably from station to station, the pattern of seasonal distribution is similar in all areas, with a marked summer maximum.

Although the monsoons bring relief from the extreme heat, they also cause difficult conditions. First, by causing high humidity which, coupled with high temperature makes the weather very oppressive; and second, by causing devastating floods which take a considerable toll of life and property. July day temperatures at most stations are below 38°C, less than those experienced during June; but relative humidity is much higher, 70-80 per cent in the morning and 60-70 per cent in the afternoon. Pressure is generally in the vicinity of 996 mb.

The monsoon current gains in strength during July, remains constant during most of August and begins to withdraw afterwards. This marks the beginning of the Post-Monsoon season which is essentially a transitional period between the monsoonal regime and the cool to wintry conditions. In some years, the monsoons remain active until late September and thus delay the commencement of the Post-Monsoon period. In October, maximum temperatures range between 31 and 36°C, clouds disappear and a dry season begins. The nights are often fairly cool and the minimum temperature remains around 16-18°C. By mid-November, both maximum and minimum temperatures have dropped by another 5°C, conditions become very dry and a high pressure area begins to set in. Like the pre-monsoon months of May and June, the post-monsoon October and November constitute the driest period, virtually devoid of any precipitation.

The above description of the prevalent weather conditions in the Punjab indicates the generally arid conditions in the Province. It is obvious that the pattern of rainfall is highly variable in amount as well as in areal distribution and the timing of its incidence. Further, it occurs mainly in summer when, due to a universally high thermal efficiency in the Province, the meagre amount of precipitation that reaches the scorched ground is not very useful for plant growth. Moreover, the monsoons usually burst in the form of heavy downpours, flooding the fields and drowning the crops, which is as disastrous in its consequence as a protracted drought.

The economic value of the summer rainfall for agriculture is, therefore, much reduced by its concentration within a short time period.

Winters, on the other hand, are mostly dry over large areas. Yet this is the time when water is badly needed for maturing the rabi (winter) crops which include the most important food grain of the region - wheat. It therefore goes without saying that, except in a small northern strip, rainfall in the Punjab is either so meagre or so uncertain or a combination of both, that it is not only of low economic value to agriculture, but also imposes a severe constraint on agricultural productivity without irrigation.

The relation between water and agriculture being crucial, an understanding of the processes of the interplay of thermal conditions and moisture in the lower atmosphere is vital. Williamson and Clark (1931) attempted a study of the rainfall variability in the whole subcontinent. According to these writers, the areas with lower average annual rainfall have a generally higher degree of variability. They showed that the southwestern part of the Punjab, which receives less than 150 mm. of rainfall, has an average variability between 30 and 40 per cent while, in the other parts of the Province, variability of rainfall ranges between 20 and 30 per cent. (25) Ahmad and Khan (1961) studied the variability of rainfall in the arid and semi-arid parts of Pakistan for the period 1864-1956. According to them, the coefficient of variability (CV) in the Punjab increases from 25 in the north to over 60 in the extreme southwest.(26) Making use of the Pakistan Meteorological Department's arid zone research, Naqvi et al (1957) computed the values of potential evapotranspiration, water surplus and deficiencies and found that in the Punjab Plain the monthly and annual rainfall are always less than the evapotranspiration, while in the submontane regions the monthly total rainfall exceeds evapotranspiration in two or three months. (27) Following Thornthwaite's classification, Khan (1968) attempted to compute a simple water budget of Pakistan

TABLE 2.3 MOISTURE DATA FOR SELECTED STATIONS IN THE PUNJAB

Station	Water need cm	Precipitation cm	Water Deficiency cm	Water Deficiency %	Moisture Index
Murree	62.12	164.01	-	-	+168.70
Rawalpindi	119.31	96.01	31.49	26.39	- 8.90
Jhelum	128.92	89.05	40.91	31.73	- 18.23
Sialkot	131.36	78.13	47.45	36.12	- 16.89
Khushab	138.98	38.79	100.23	72.11	- 43.27
Lahore	137.28	49.02	88.26	64.29	- 38.57
Sahiwal	140.20	26.11	114.09	81.37	- 48.43
Multan	145.52	16.31	129.21	88.79	- 53.27
Bahawalpur	142.66	14.19	128.47	90.05	- 54.03
Fort Abbas	148.11	19.60	128.51	86.76	- 52.06

SOURCE : Khan (1968)

by estimating evapotranspiration, water need, water surplus and water deficiency in the country. (28) Comparative moisture data for ten selected stations in the Punjab as calculated by Khan are given in Table 2.3. It is interesting to note that the values of the moisture index - a measure of the efficiency of precipitation - are negative everywhere except at Murree (2200 m.) which presents an exceptional case with its high latitudinal and altitudinal location. This indicates that dryness caused by the insufficiency of moisture is the most conspicuous element of the Punjab's climate, which makes irrigation an absolute necessity.

2.6. DEVELOPMENT OF IRRIGATION

Induced by the severity of the climate, in particular the deficiency and inefficiency of rainfall, and aided by the perennial water supplies and the very gentle gradients of the Punjab's well spread rivers, irrigation has been an ancient practice in the Province. Although the rivers have since changed their courses and all vestiges of ancient canals have been obliterated, there is ample evidence that agriculture during the apogee of the Indus Valley Civilization, about 5000 years ago, was supported by irrigation. (29) However, the inundation irrigation then in vogue was a hazardous undertaking. Being possible only during the period of high river regimes in summers or the kharif crop season and restricted to the riverine tracts, it was limited areally as well as seasonally. And although, at some places, the period of flood irrigation was extended by building ponds, it remained overall a precarious means of agriculture. However, every ruler who ruled over the "Five Rivers", did something for irrigation. (30)

The first perennial canal in the Punjab was built on the Ravi during the reign of the Moghul Emperor Jahangir (1605-27), to irrigate the royal gardens near Sheikhupura. His example was followed by his successor, Shahjahan (1627-58), during whose reign another canal, the Huslie , was built on the Ravi in 1633, to irrigate Lahore's Shalamar Gardens. However,

despite these early ventures, perennial irrigation remained a very limited practice and at the time of the British annexation of the Punjab (1849), inundation canals were more widespread in the region with almost every district containing flowing canals or else the ruins of ancient water courses. (31) The British tried to renovate the existing system and in 1872 there were 4,000 km. of inundation canals in the British Punjab, irrigating more than 400,000 ha. of cropland. (32)

In addition to undertaking the renovation and extension of the inundation system, the British, despite their lack of experience in the field, decided to build the Province's first modern perennial canal.

> "It was after their early commercial exploits, when the British took fancy to governing a vast subcontinent and established an administration which gradually became interested in promoting Western ideas and the establishment of lasting links with the land which came under their political control" (33)

Soon after the Punjab's annexation, the plan to build the first modern canal - the Upper Bari Doab Canal (UBDC) - was prepared. The motives behind the UBDC were partly the self-interest of the British in improving the agricultural value and thus the revenue-producing capacity of the newly annexed lands and partly to demonstrate good will to the native population, an overwhelming majority of whom derived their subsistence from land, by participating in their welfare and gaining their support and confidence in return. One of the aims was also to provide employment in such public works for the soldiers of the recently disbanded Sikh army, who had lost their jobs following the Province's annexation. (34) While the fear of recurring famines was an obvious motivating factor, the British zeal to demonstrate that European scientific know-how could far excel anything indigenous cannot be ruled out in preparing numerous irrigation and developmental schemes. (35) The UBDC was finally opened in 1859, receiving its flow from the Ravi at Madhopur, a point where the river debouches from the Siwaliks; and irrigation by this canal started in 1861. It was subsequently improved by the end of the nineteenth century.

Encouraged by the success of the UBDC and benefitting from the experience gained during and after its construction on the one hand, and pressed by the need to expand the subcontinent's food supply on the other, the British Government decided to develop the potentially fertile Punjab plains by large scale irrigation. Thus, an elaborate programme involving construction of numerous diversion dams, barrages and weirs and an extensive network of canals was undertaken as early as 1870. The idea now was to introduce water to the Crown Wastelands and to settle them with surplus population from the "overpopulated", mainly rain-fed northeastern districts of the Province. Michel (1967) has counted three obvious advantages in this approach; 1) it would relieve congestion and thus the possibility of famine in the populous settled districts; 2) it would bring under the plough vast tracts of wasteland, hitherto inhabited by the lawless nomads and junglis and thus increase the revenue production; and 3) the newly developed areas would eventually supply their surplus food produce not only to the densely peopled districts of the Province but to the other less productive or/and high density areas of the subcontinent.(36) Hameed (1972) has, in addition, perceived three more objectives in the expansion of irrigation and the resulting agricultural and economic development of the Province; 1) to create, establish and promote settlements superior in comforts and amenities to the previous; 2) to encourage the undertaking and maintenance of stables for horses and camels; and 3) to establish irrigated forest plantations for meeting the fuel requirements of the railways. (37) To these, another point may be added - the creation of a new landed aristocracy, loyal to the crown. The Punjab with its immense strategic and economic value, enjoyed an important position in British India and, to consolidate British rule in the area, it was vital to win the confidence of the Punjabis in the new administration and to establish the raj on a sounder and firmer footing, with support from the mass of the population. Now, in order to settle the newly irrigated areas, it was envisaged that the cultivators would immigrate into these areas from

the northeastern districts. They did, and they were alloted land for settlement in these newly opened canal colony areas. But at the same time, not only the already existing yet fading class of jagirdars (feudalists) - the old nobility of the Moghul days - was greatly benefitted, but a sizeable class of new jagirdars was also created. Since the jagirdars would play an important role to safeguard their interests as well as those of their benefactors, vast tracts of land in the "new" areas were distributed amongst them, mainly as rewards for some "meritorious" services. In this way, a reinvigorated feudalism was successfully planted in the Province which, in the coming years, played a significant role in keeping the rural dominated Province under "control". As a result, the Punjab became rich and the subcontinent's granary on the one hand, but a feudalist dominated province on the other. The latter aspect undoubtedly contributed to the Province's quiescence and a low-key role in the anti-British Independence movement for quite some time.

The elaborate programme of irrigation development in the Province continued with the passing decades and, by the middle of the twentieth century, all the main rivers of the Punjab had been harnessed. As a result, at the time of Independence in 1947, the region had the most extensive canal irrigation system in the world. (38) Together these canals produced over 8 million ha. of new irrigated land, of which 85 per cent lay in Pakistan.(39)

Following the birth of Pakistan, the programme of developing and expanding canal irrigation in the Province continued and the Jinnah and Taunsa Barrages were successfully completed in 1947 and 1958 respectively. In addition, the irrigation works necessitated by the Indus Waters Treaty (1960) were accomplished. Table 2.4 shows the details of the major irrigation canals in the Punjab constructed before and after Independence, while Figure 2.4 indicates the location of head works and barrages, and the canal courses.

TABLE 2.4

MAJOR IRRIGATION CANALS OF THE PUNJAB

Name of the Canal	River	Year of first Irrigation	Length of main Canal km	Districts Irrigated	Area Irrigated 1966-7 000 ha	Canal Withdrawals, 1969-70 mill. m^3
Central Bari Doab*	Ravi	1860	(x)	LHR	261	1,634
Lower Bari Doab	Ravi	1913	211	LHR, SWL, MTN	735	5,639
Sidhnai	Ravi	1886	107	MTN	467	2,968
Upper Chenab	Chenab	1912	277	SLT, GWA, SHA	358	3,155
Lower Chenab	Chenab	1887	754	GWA,SHA,JNG,LYP	1,394	8,707
Upper Jhelum	Jhelum	1915	205	GJT, SRG	221	3,557
Lower Jhelum	Jhelum	1901	290	GJT, SRG	631	3,546
Rangpur	Chenab-Jhelum	1939	(x)	SRG, JNG, MZG	108	1,115
Thal	Indus	1947	(x)	MWI, MZG	440	4,928
Taunsa	Indus	1958	(x)	DGK, MZG	361	6,472
Dipalpur	Sutlej	1927	251	LHR, SWL	257	1,448
Pakpattan	Sutlej	1926	320	SWL, MTN	484	4,156
Fordwah	Sutlej	1927	(x)	BWP, BWN	115	1,184
Eastern Sadiqia	Sutlej	1927	127	BWP, BWN	287	3,493
Qaim	Sutlej	1927	12	BWP	15	141
Bahawal	Sutlej	1927	(x)	BWP	193	2,849
Mailsi	Sutlej	1927	171	MTN	253	1,863
Panjnad	Sutlej	1933	(x)	RYK	488	4,744
Abbasia	Sutlej	1933	(x)	RYK	41	567

* Central Bari Doab is the name of the Pakistani part of the Upper Bari Doab Canal

(x) Not Available

SOURCES : 1. Census of India 1931 (Vol XVII)

2. Pakistan Statistical Yearbook 1968

3. Agricultural Statistics of Pakistan 1975

With the completion of various irrigation projects, mainly in the Punjab and Sind, the average annual canal withdrawals in Pakistan rose by 31 per cent, from 80.2 thousand million m^3 in 1947-8/1950-1 to 105 thousand million in 1961-2/1965-6. (40) During the quinquennium 1948-9/1952-3, the average annual irrigated area from all sources in Pakistan was 9.2 million ha., of which 7.4 million ha. or over 80 per cent was canal irrigated. By the quinquennium 1970-1/1974-5, the annual average of the total irrigated area had increased to 13 million ha. and that of the canal irrigated to 9.7 million, an increase of 41.3 and 31.1 per cent respectively. The total irrigated area in the latter period amounted to 76 per cent of the total cropped and, out of this, 74.6 per cent was irrigated by canals. The drop in the share of canal irrigated area as well as its slower increase rate was due to the groundwater development, especially after 1961-2.

In the Punjab the average irrigated area per year from all sources during the five-year period 1948-9/1952-3 was 5.9 million ha. or 69.4 per cent of the Province's total cropped area. Of this, 4.7 million ha. or 79.7 per cent was watered by canals. Thus, 64.1 per cent of Pakistan's total irrigated and 63.5 per cent of its canal irrigated area lay in the Punjab during that period. By the quinquennium 1970-1/1974-5, the Province's irrigated area from all sources had risen by 55.9 per cent, to 9.2 million ha. The canal irrigated area, which at the beginning of the period was 79.7 per cent of the total irrigated, rose from 4.7 million to 6.6 million ha. - an increase of 40.4 per cent. However, its share in the Province's total irrigated area declined by 8 percentage points, once again owing to the shift of emphasis towards the development of groundwater resources. But the Punjab's share in Pakistan's total irrigated and canal irrigated areas rose to 70.8 and 68 per cent respectively.

A striking aspect of canal water supply is its variation between

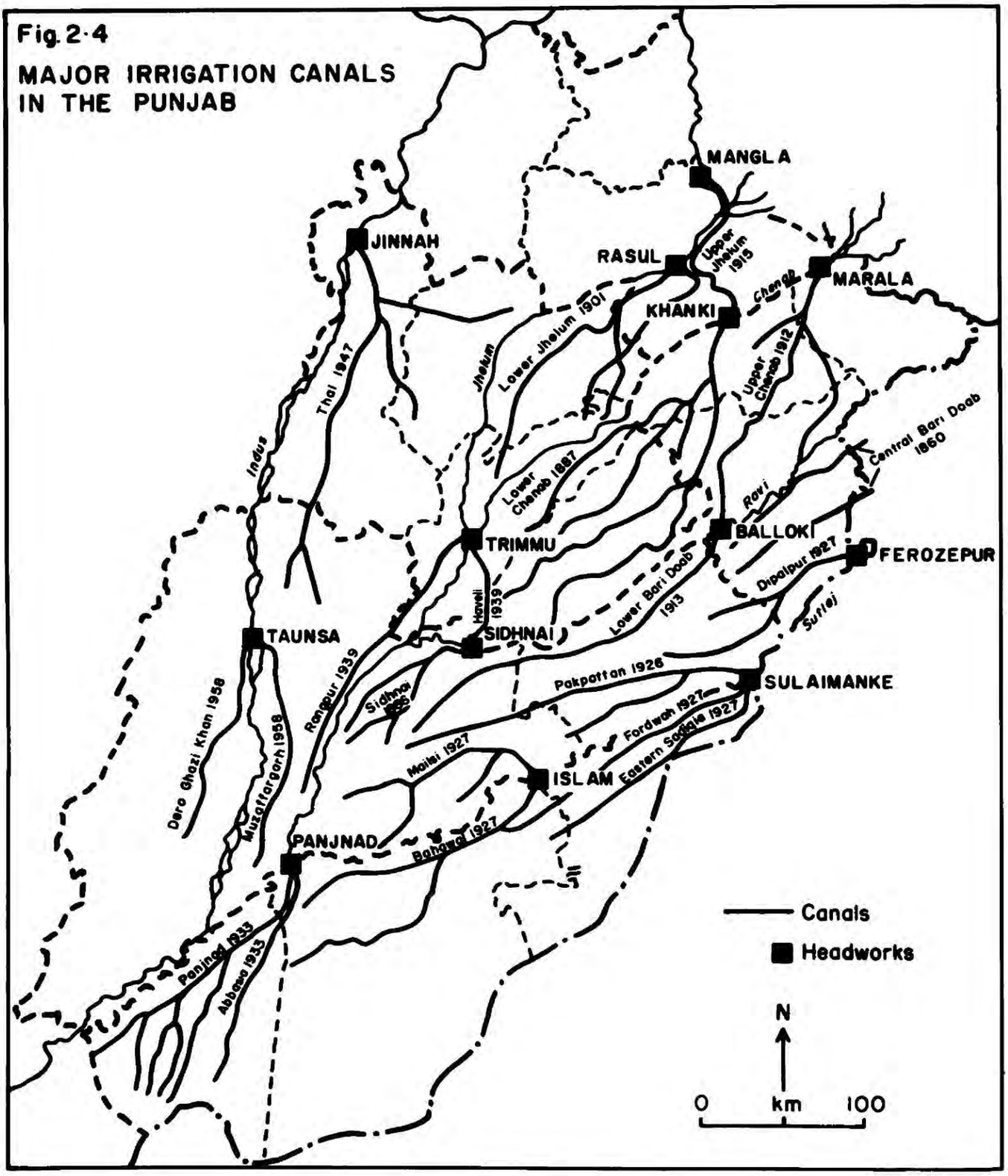


Fig. 2·4
MAJOR IRRIGATION CANALS
IN THE PUNJAB
MANGLA
JINNAH
RASUL
Upper Jhelum 1915
MARALA
KHANKI
Chenab
Lower Jhelum 1901
Jhelum
Thal 1947
Indus
Upper Chenab 1912
Central Bari Doab 1860
Lower Chenab 1887
Ravi
BALLOKI
TRIMMU
FEROZEPUR
Dipalpur 1927
Lower Bari Doab 1913
Sutlej
Haveli 1939
TAUNSA
SIDHNAI
Rangpur 1939
Pakpattan 1926
SULAIMANKE
Sidhnai 1965
Fordwah 1927
Eastern Sadiqia 1927
Dera Ghazi Khan 1958
Muzaffargarh 1958
Mailsi 1927
ISLAM
PANJNAD
Bahawal 1927
Panjnad 1933
Abbasia 1933
Canals
Headworks
N
0
km
100

seasons. As Table 2.5 shows, during the summer or kharif crop season, the water flow in the canals is at its maximum while during most years, the rabi or winter season flow is less than half of what it is during the summer. This reflects the fluctuations in the river supplies (Section 2.4). Accordingly, the amount of irrigated areas shows a marked seasonal variation.

Until the advent of large scale canal irrigation in the Province, underground wells were, in addition to the inundation canals, a major source of irrigation water. In fact, they provided, in many ways, a better, more trusted and preferred means of irrigation than the inundation system, but they started losing their importance with the expansion of perennial canal irrigation. However, the decline in the importance of well irrigation by no means took place equally in all parts of the Province and wells continued to be a popular source of water for crops in many districts of the Punjab, especially those in the northeast and the centre of the Province where, due to a relatively higher water table, they were convenient to operate. During the five-year period 1948-9/1952-3, the annual average of the well irrigated area was 975,000 ha. - 17 per cent of the total irrigated area - and in some districts such as Sialkot, Lahore, Gujrat and Jhang, the share of the well irrigated land was even higher.

A significant change in the exploitation of underground water took place in the early 1960's, when a number of farmers in the Province started investing in the development of ground water on their farms by sinking tube wells. By 1963, there were 16,000 tube wells in Pakistan, of which about 94 per cent were in the Punjab. Three years later, the number of tube wells had multiplied nearly four-fold, with the Punjab having 93 per cent of the total. By 1973-4, Pakistan's total had reached 131,000, with the Punjab still maintaining its high share at 91 per cent. This certainly had a great bearing on the pattern of water utilization in the Province. Although the share of the canal irrigated area declined, there was a sharp rise in the

TABLE 2.5 WITHDRAWAL OF WATER FROM IRRIGATION CANALS IN THE PUNJAB, 1969-70/1974-5

Year	Annual withdrawal	Summer (kharif) withdrawal April-September		Winter (rabi) withdrawal October-March	
	000 mill m^3	000 mill m^3	%	000 mill m^3	%
1969-70	62.2	42.6	68.5	19.6	31.5
1970-1	54.5	38.4	70.5	16.1	29.5
1971-2	48.1	35.6	74.0	12.5	26.0
1972-3	61.3	40.2	65.6	21.1	34.4
1973-4	53.3	32.5	61.0	20.8	39.0
1974-5	52.0	36.5	70.2	15.5	29.8

SOURCE: Agricultural Statistics of Pakistan 1975

amount of water available for irrigation. As a result, not only the irrigated area rose at a faster rate, but more water became available for the existing irrigated tracts. This has been interpreted as the beginning of the "Green Revolution" in the Province, since it created the necessary infrastructure for the momentous change that took place a few years later, with the introduction of high yielding varieties of crops. (41)

There are marked regional variations in the extent of irrigated area, its share in the total cropped and also in the relative share of the various sources of irrigation. These are discussed in detail in Section 5.5.

2.7. SOILS

A large part of the Punjab, having been formed by fluviatile material, has basically alluvial soils which have developed under almost similar climatic conditions and a general absence of vegetative cover over large expanses. The alluvium forms one continuous series but a sharp distinction exists between bhangar (old alluvium)and khaddar (new alluvium). Moreover, a careful investigation reveals that the alluvial material can be coarse or fine depending upon its location and the water current from which it was deposited. Bhangar or older soils are confined to the higher layers, above the annual flood level of the rivers. These soils are deep and well consolidated and reinforced by kankar (modular limestone). With medium to fine texture, they have a high content of calcium carbonate and a low proportion of organic matter; but are very productive when irrigated. In some parts of the Chaj and Rechna doabs as well as along the eastern fringes of the Potwar Plateau, the bhangar soils have developed under sub-humid conditions where, due to a relatively higher rainfall, they have been leached of lime which explains their slightly higher organic content. Khaddar or newer alluvial soils are formed by recent river borne sediments and thus cover the lower terraces and flood plains of the rivers. They are spread over

large part of the Punjab Plain and receive,in every flood season, fresh layers of silt loam and silty-clayey loam. Like the bhangar soils, the organic material in the khaddar is low.

In the submontane and the Potwar regions, the proportion of alluvial soils is very small since they are confined to the valleys in the form of patches. The soils of these regions are shallow, residual as well as transported, with high lime content and low organic matter. Subjected to a high degree of erosion, the soils in the Potwar are massive and strongly gullied. But they can be rendered productive given an abundant water supply. The soils in the Thal and Cholistan, on the other hand, are typical desert types; medium and coarse sand constitutes a large part of the surface. In places, aeolian material overlies the old alluvium.

In brief, leaving aside minor problems, soils over a large part of the Punjab, especially in the irrigated plain areas, do not impose a severe constraint on plant growth. Instead, most of the soils, with favourable textures and a high potential productivity, provide a satisfactory medium for agricultural development. Further, due to a good moisture retention capacity, they provide favourable conditions for irrigation.

2.8. AGRICULTURAL DEVELOPMENT POTENTIAL

Soils being conducive for irrigation,and irrigation, in turn, having been facilitated by copious water supplies through the Province's rivers, the Punjab has been a propitious region for agriculture throughout its history. A significant revolution in this field, however, began in the last quarter of the nineteenth century when water and soil, the two fundamental ingredients of the agricultural potential, began to be exploited intensively as well as extensively. With the introduction of modern irrigation technology, perennial irrigation increased substantially and, in turn, replaced the old but ineffective inundation system. As a result, the old waterless, "terra incognita" of the pre-canal days which was "an endless waste of bush

TABLE 2.6 POPULATION, CULTIVATED AREA AND CANAL IRRIGATED AREA IN THE BRITISH PUNJAB, 1868 - 1931

Year	Population		Cultivated Area		Canal Irrigated Area		Share of canal irrigated in cultivated Area	
	000	% change	000 ha	% change	000 ha	% change	%	change
1868	15,799	-	8,163	-	556	-	6.8	-
1881	16,939	+7.2	9,470	16.0	789	41.9	8.3	+1.5
1891	18,653	+10.1	10,522	11.1	1,221	54.8	11.6	+3.3
1901	19,943	+6.9	11,250	6.9	2,024	65.8	18.0	+6.4
1911	19,579	-1.8	11,453	1.8	2,925	44.5	25.5	+7.5
1921	20,685	+5.7	11,736	2.5	4,158	42.2	35.4	+9.9
1931	23,581	+14.0	12,250	4.4	5,018	20.7	41.0	+5.6

SOURCES : computed from 1. Census of India 1931 (Vol XVII)
2. Paustian (1968)

and scrub with little sign of life beyond the uncertain footmark of camel, buffalo and goat, and the movable dwelling of the nomad grazier, with its roof of thatch propped upon wooden poles" (42), gradually became a prosperous agricultural region. Table 2.6 shows the change in the cultivated and the canal irrigated area in the British Punjab between 1868 and 1931, in comparison to the population change in the Province. It will be seen that, during the four intercensal periods preceding 1911, the increase in the cultivated area was more rapid than the corresponding population change. Moreover, the percentage of canal irrigated area rose sharply. During the period 1868-1931, the canal irrigated area rose by 802 per cent and the total cultivated by 50 per cent, which is indicative of a remarkable agricultural development in the area whose population rose, during that period, by 49 per cent.

As has been discussed in section 2.6, development of irrigation has continued in the Province after Independence. The area under the plough has, therefore, registered a gradual increase. The cultivated area of the Punjab rose from 9.1 million ha. in 1948-9/1952-3 to 11.1 million in 1970-1/1974-5. Whereas at the beginning of the period,44.2 per cent of the Province's territory was under the plough, towards the end of that period, this had increased to almost 54 per cent.

The proportion of cultivated area in the total area exhibits pronounced regional variation. Whereas in Bahawalpur district a mere 14.2 per cent of the total area was under cultivation during the period 1970-1/1974-5, in five districts - Lyallpur, Sialkot, Gujranwala, Multan and Sahiwal - the level was much above 80 per cent. The distribution and change of agricultural areas is dealt with at length in Chapter V.

2.9. SUMMARY AND CONCLUSION

Irrigation has been an absolute necessity in the Punjab in view of the high spatial and seasonal variability and low efficiency of rainfall. The glacial origin of the Province's rivers, on the other hand, together with their fine pattern of flow, has provided excellent opportunities for their water

to be exploited for crops. So, pressed by climatic stringencies and stimulated by the natural setting of the rivers, man in the Punjab learnt, in the remote past, to irrigate his land particularly in the Province's plain areas. But the inundation system thus evolved was, as was natural rainfall, an erratic source of water since it depended on the level of river water or in other words, on the caprice of the "river gods". Inundation canals were, therefore, supplemented by a rather more permanent and reliable source of water, the wells. These could not, however, be dug everywhere since their economic and profitable functioning depended on the underground water table as well as on the quality of water. Moreover, run by bullocks, these wells could render only a limited water supply.

The first remarkable change in the age old pattern of water utilization in the Province took place in the last decades of the nineteenth century with the introduction of modern canal irrigation. By providing water for crops on a perennial basis, modern irrigation technology not only revolutionized the pattern of irrigation but also gave new dimensions to the region's economy with far-reaching effects.

The second significant change in the Punjab's irrigation occurred during the early 1960's, when renewed efforts were made to develop the Province's ground water resources. As a result, thousands of power-run tube wells were installed which increased the availability of water for irrigation.

The first change in the pattern of irrigation is associated with the "demographic revolution" in the area since, as a result of the new and reinvigorated basis of the Province's economy, a massive redistribution of population took place. The second change in the Punjab's pattern of water utilization is linked with the "Green Revolution" in the area since it laid down the foundation for the introduction of the high yielding varieties of crops. Both these "revolutions"- demographic and green- form the subject of discussion in the following chapters.

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18. The points where the rivers enter the plains. These are : Kalabagh for the Indus, Mangla for the Jhelum, Marala for the Chenab, Madhopur for the Ravi, Pong for the Beas and Rupar for the Sutlej.
19. Below Kalabagh (200 m. ASL) the length of the river course is 1500 km. where it flows on an average gradient of 1:7,500
20. Kureshy, 1977, 26
21. Khosla, 1958, 233
22. Ahmad, 1951, 1
23. This section draws upon Naqvi and Rahmatullah, 1962, 1
24. Some of these disturbances might originate as secondary depressions over Iran which may occasionally become more significant than the primary depressions rising further north. Spate et al, 1967, 51
25. Williamson and Clark, 1931, 43
26. Ahmad and Khan, 1961, 35
27. Naqvi and Rahmatullah, 1962, 1
28. Khan, 1968, 12
29. Michel, 1967, 47
30. General Report on the Administration of the Punjab for the Years 1849-50 and 1850-51, London, 1854, cited in Ibid, 65
31. Ibid
32. Buckley, 1905, 11
33. Hameed, 1972, 35
34. Buckley, 1905, 17

35. Michel, 1967, 66
36. Ibid, 75-76
37. Hameed, 1972, 42-43
38. Michel, 1967, 51
39. Tayyeb, 1966, 200
40. Lieftinck et al, 1968, 10
41. Burki, 1974, 17
42. Darling, 1932, 117

CHAPTER III

EVOLUTION OF POPULATION

3.1. GENERAL CHARACTERISTICS OF POPULATION EVOLUTION IN PAKISTAN AND THE PUNJAB

Pakistan, which was a part of British India before it achieved independence on 14 August 1947, had a very slow population growth before the twentieth century. The population of the subcontinent Indo-Pakistan indeed experienced vicissitudes in its growth; however the overall impression is that it remained more or less stationary for almost two millennia before the advent of the colonial era. Even after the establishment of colonial rule, the subcontinent's population growth remained slow for a long time. For instance, considering the recent estimates, the subcontinent's population registered an increase of 19.5 per cent during the first half of the nineteenth century at an average annual rate of 0.3 per cent - the rates rose to 22.3 and 0.4 per cent respectively during the latter half of the nineteenth century. (1)

According to the figures suggested by Davis (1951), the population increase between 1871 and 1921 was a modest 20 per cent with an average annual growth of 0.37 per cent. (2) Slow growth during this period is attributed to the famines of 1876-7, 1877-8 and 1900-01 as well as decimation by plague, cholera, and malaria epidemics at the end of the nineteenth century which killed some 5-6 million. (3) In addition, almost 20 million perished in the influenza epidemic of 1918-19. (4) However, the rate of population increase in the areas now constituting Pakistan remained higher than in many other parts of the subcontinent.

In 1901, Pakistan's population was 16.6 million. By 1951, the total had doubled, suggesting an average annual growth rate of 1.4 per cent. It had nearly doubled again by 1972 in almost two decades, at an average growth rate of 3.1 per cent per year. During the period 1901-72, intercensal rates of population growth in Pakistan varied between 8.9 and 52.2 per cent with annual increases of 0.86 and 3.67 per cent respectively. While during the period 1901-75, the average annual growth rates of the world's and Asia's (excluding the USSR) populations

were 1.2 per cent and that of the subcontinent's 1.3 per cent, Pakistan's was a little over 1.9 per cent.

The highest intercensal growth rate - 52.2 per cent - in Pakistan's demographic history was recorded between 1961 and 1972, which suggests an annual increase of almost 3.7 per cent. The country's population size during this period increased from 42.9 to 65.3 million and was estimated to have risen to over 84 million by mid-1979. (5) However, the annual rate of population growth is assumed to have declined to 2.8 per cent between 1975 and 1979. (6)

The Punjab, the leading province of Pakistan with 57.6 per cent of the nation's population, has been the country's fastest growing region, where the population growth was rather modest during the first half but spectacular in the third quarter of the twentieth century. The Province's population was 10.3 million in 1901 and 20.7 million in 1951 and is estimated to have passed 40 million by the end of 1974. (7) This means, the Province's population doubled itself first in 50 years and again in 23 years, suggesting annual increase rates of 1.4 and 3 per for the periods 1901-51 and 1951-74 respectively. Thus, the average growth rate more than doubled during the third quarter of the twentieth century from what it was in the first half of the century. And, although the Province's share in the national population has fluctuated between 62.2 per cent in 1901 and 57.6 in 1972, with a minimum of 55.7 per cent in 1921, its population has continued increasing rapidly.

3.2. A HISTORICAL ACCOUNT OF POPULATION EVOLUTION

As a background to any study of the present-day population geography of the Punjab, it is appropriate to examine the trends in the Province's population evolution during the nineteenth and early twentieth centuries, and also before that time, in the wider context of Pakistan and the subcontinent.

Throughout the ages, the subcontinent is believed to have supported one of the world's largest populations. Herodotus (c.485-425 BC) referred to the

subcontinent as the most populous amongst the countries of the world. (8) The practice of some sort of population registration was apparently well established in the subcontinent before the Christian era began. Details furnished about the Mauryan period (c.322-184 BC) by Kautilya's Arthasastra or "Treatise on Polity" (c.300 BC) and testified by Megasthenes, the Greek traveller of the same period, tend to show that the subcontinent supported a large population size. (9) Being proximate to the origin of Neolithic cultural traits, the subcontinent received these traits earlier than, for example, most of today's developed western world. This provided the area a basis for supporting a high population density by the standards of the time. (10)

In the absence of a reliable and continuous record, it is extremely difficul to make an accurate assessment of the region's population size at various stages of its ancient history. Nevertheless, from the fragmentary evidence available, numerous attempts have been made to estimate the region's population size since as far back as 10,000 BC (11) though, in view of the sketchy nature of the record, the figures should be taken with great caution.

In the present study, the region's population evolution is discussed in three stages; the pre-British period(before 1855), the British period (1855-1947) and the post-Independence period (after 1947). This tripartite division of the historical time scale is rather arbitrary and is dictated, inter alia, by the fact that the census activity in the subcontinent in its modern form started with the advent of British rule which marked a watershed in the region's demographic history. Following is a detailed historical account of population evolution in the region.

3.2.1. The pre-British Period (Before 1855)

Archaeological remains bear evidence that the parts of the subcontinent which now constitute Pakistan were the cradle of the Indus Civilization. The finds from various excavations at Harappa (25 km. southwest south of Sahiwal city in the Punjab) on the left bank of the Ravi, and Moenjodaro (district Larkana

in Sind) on the right bank of the Indus, approximately 400 km. from its mouth, confirm the existence of a well developed civilization as far back as the third or fourth millennium BC and probably much earlier. There were large populous and well planned cities with well built houses, temples and public buildings and numerous other amenities comparable to those enjoyed by the contemporary Mesopotamians and Egyptians. These cities did not follow a haphazard growth but were rigorously planned in rectangular blocks with great consideration for security and Hygiene. (12)

The Indus Civilization, sometimes called the "Harappa Culture", was a Bronze Age culture, quite similar to Sumerian in technical accomplishment (13) and is believed to have derived its wealth basically from agriculture. (14) In addition to the people inhabiting the Indus Valley, another group with similar accomplishments were the Aryans who are thought to have descended upon the subcontinent from the northwest around 2000 BC, at a time when the Indus Civilization had reached a high pitch of organization. The Aryan invasion was supposedly prompted by the subcontinent's prosperity.

In view of its well developed economy and society, it seems likely that the subcontinent supported a dense population. McEvedy and Jones (1978) have suggested a total population of 100,000 for the subcontinent in the 10th millennium BC, about one million in 4000 BC; and six million in 2000 BC when the Indus Civilization was in full flower. (15)

In the absence of a reliable record it is indeed difficult to estimate the population size of the areas now forming Pakistan during the prehistoric period. However, considering that these were the areas where an overwhelming part of the developed civilization concentrated, it could be argued that the bulk of the subcontinent's people lived in what is now Pakistan. Further, since the Harappa Culture formed a dominant part of the Indus Civilization and it originated and flourished in the Punjab, the Province could have supported a sizeable population during the climactic phases of the Civilization. This is supported by the

suggestion that, out of the subcontinent's total of six million people around 2000 BC, possibly five million (or 83 per cent) lived in the Indus Valley. (16)

By the middle of the second millennium BC, the Indus Civilization had collapsed, possibly due to the Aryan incursions. As the Aryans occupied the fertile Indus Valley, the indigenous inhabitants were either subjugated or pushed southwards, and as the invaders attempted to impose their agro-pastoral culture on the native population, the large urban settlements were reduced to tiny sizes characterized by shoddy dwellings. (17) Thus, the prosperous civilization which had earlier acquired a technology and attained a degree of economic affluence sufficient to support a dense population, was plunged into a dark age.

An upturn from this dark age took place in the eighth century BC when, according to the Brahman literature (c.800-600 BC), some of the villages had grown into towns and capitals with an urban life style. (18) It is likely that, in time, the tribal-pastoral culture of the Aryans blended well with the indigenous, resulting in a new cultural complex. This was the time when the country's demographic centre moved to the Gangetic lowlands of present-day Bangladesh and the Indian north and east where it has remained ever since. (19)

The middle of the seventh century BC marks the commencement of the subcontinent's recorded history. Being a period of progress characterized by maritime commerce and the diffusion of the art of writing, it provides a milestone after which various events can be dated fairly accurately. (20) According to the Buddhist literature, the economic conditions of northern India between the seventh and fourth centuries BC were comparable to those prevalent in later medieval Europe. (21)

The subcontinent's first real empire was founded by Chandragupta Maurya (c.322-298 BC) after Alexander had quitted the Punjab and his death in 323 BC had dispelled all fears of his return. In its heyday (c.250 BC) under Chandragupta's grandson, Asoka (c.269-232 BC), the Mauryan empire stretched from the Hindu Kush in the northwest to Brahmaputra in the southeast, only a small

territory in the peninsula remaining outside. Glimpses of the material progress and socio-cultural prosperity during the Mauryan period are provided by Kautilya's Arthasastra (c. 300 BC). Intensive agriculture, fairly well developed irrigation, abundant trade and commerce, well developed road networks and waterways, the functioning of courts of justice, the use of written commands, the well developed system of land revenue, the sophisticated population registration system, the institution of census (Section 1.6), use of metals, promotion of industrial arts and, above all, an elaborately organized and massive army speak of a high degree of civilization. (22)

The conditions enumerated above lead to the conclusion that the subcontinent had a substantial population before the Christian era. Nath (1929) estimated, on the basis of the reported number of gramas (estates), that the subcontinent's population was 100-140 million around 300 BC. (23) Since according to most sources, the world's total population was around 250 million at the dawn of the Christian era (24), the subcontinent's total of 100-140 million looks rather high. Davis (1951) is, however, inclined to accept it. (25) McEvedy and Jones (1978), on the other hand, place the subcontinent's total at only 25 million around 500 BC and 30 million around 200 BC. (26) There is obviously a substantial difference between the two estimates; however the lower estimate of McEvedy and Jones is partly explained by the fact that their estimate of 170 million for the whole world at the beginning of the Christian era is also much lower than others.

After the decadence of the Mauryan dynasty, the subcontinent witnessed another spell of economic prosperity and cultural revival under the Guptas. During the reign of Chandragupta II Vikramaditya (c. 385-413), the empire extended from the Chenab to Bengal and, with the revival of some of the glories of the Mauryan age, the country's population is thought to have touched another peak. Fa Hein, the Chinese Buddhist pilgrim (400 AD) observed that the people were numerous and prosperous.(27) According to Clark (1967), the subcontinent's population was 75 million in 350.(28)

The Gupta empire was shattered in c.540 AD due to the irruptions of the nomads from central Asia - the White Huns. The ensuing anarchy was only briefly mitigated during Harsha's rule (606-647) when another rise in the population occurred. According to Bana, the historian of Harsha's period, his army consisted of 100,000 cavalry and 60,000 elephants which is believed to be indicative of a substantial population size. (29)

Hiuen Tsang (or Yuan Chwang), the Chinese pilgrim who visited the subcontinent during this period (629-645), noticed vast empty stretches of land in the country; but Kanauj, the capital, was a sizeable city with all signs of prosperity. (30) Considering the information given by Hiuen Tsang's travelogue about the length of walls surrounding a number of India cities as well as the inter-city distances, and making use of the rank-size relationships, Russell (1969) estimated the subcontinent's population between 22 and 37 million during the first half of the seventh century. (31)

In contrast to Nath's (1929) estimate of 100-140 million, supported by several other writers, that given by Russell (1969) is very low indeed. However, the author defends it on the grounds that it is in line with that of the contemporary Mediterranean-European area. The main factor of uncertainty in Russell's estimate seems to be the level of urbanization, estimated on the basis of historical studies in other regions. (32) It is likely that, in the seventh century, the subcontinent had a very low urban-rural population ratio. If this were accepted, Russell's estimate could perhaps be revised upwards.

Consequent upon Harsha's death (647 AD), the subcontinent suffered from increasing internal strife. There emerged a host of Kingdoms, entangled in an incessant and indecisive struggle for dominance. It was against this background that the Muslim Arabs entered the area from the southwest in 712. However, real Muslim supremacy was established in the subcontinent in 1206 by the invaders from Afghanistan and continued, with changes in dynasties and territorial extent, until 1857 when it gave way to the British. It was during these centuries

that the region experienced another glorious period, under the Moghuls (1526-1857). The accounts of official and other historians and the diaries of foreign travellers provide glimpses of the subcontinent's economic and social life during this period. Nizamud-Din Ahmed, the historian of the Moghul court during Akbar's reign (1556-1605), for example, narrates in his famous Tabakat that the empire, which at that time had established its name in cultural, educational and artistic accomplishments, encompassed the entire subcontinent except its peninsular segment and contained 3200 towns of which 120 were large cities and upon each town depended 2000 to 1000 villages. (33) Considering Nizamud-Din's minimum town to village dependency factor and assuming that an average village contained roughly 30 households or a population of 150, Gupta (1972) estimated the rural population of the subcontinent at 100 million at that time. (34)

A careful estimate of the subcontinent's population was made by Moreland (1920) for the beginning of the seventeenth century, at the time of the Moghul Emperor Akbar's death (1605). (35) For the statistical basis of his computations, Moreland draws upon the size of the armed forces for southern India; and the size of the cultivated area, the labour required per unit of cultivated area and the dependents' ratio to agricultural labour for northern India. He thus arrives at an estimate of 100 million for the subcontinent's total population near the merger of the sixteenth and seventeenth centuries. To support his estimates, Moreland quoted a variety of evidence provided by contemporary foreign visitors indicating a high population density.

The keystone nature of Moreland's estimates is widely acclaimed but numerous deficiencies are pointed out. As a result, Moreland's estimate of 100 million was revised to 125 million by Davis (1951), 110 million by Datta (1960), 140 million by Durand (1965) and 135 million by Gupta (1972). Clark (1967) is, however, inclined to accept Moreland's estimate. (36)

It follows from the above that firstly, the subcontinent was one of the world's most populous regions long before the Christian era began and secondly,

TABLE 3.1 POPULATION ESTIMATES OF THE INDO-PAKISTAN SUBCONTINENT AND PAKISTAN, 300BC - 1950 AD

(Millions)

Territory	Source	300BC	1AD	400	800	1200	1600	1750	1800	1850	1875	1900	1950
Indo-Pakistan Sub-continent	McEvedy and Jones	28	34	45	62	83	130	170	185	223	246	282	431
	Zelinsky et at	-	-	-	-	-	-	190	195	233	-	285	434
	Davis	100-140	-	-	-	-	125	-	120	175	255	285	-
	Clark	-	70[a]	75[b]	75	75	100	200	190	-	-	-	-
	Clarke	-	-	-	-	-	-	190	195	233	255	285	438
	Av.Annual Growth Rate (%)during preceding period	-	0.06	0.02-0.07	0.0-0.08	0.0-0.07	0.07-0.11	0.18-0.46	-0.10-0.17	0.36-0.69	0.36-1.52	0.45-0.54	0.86
Pakistan	McEvedy and Jones									11	12	16	33

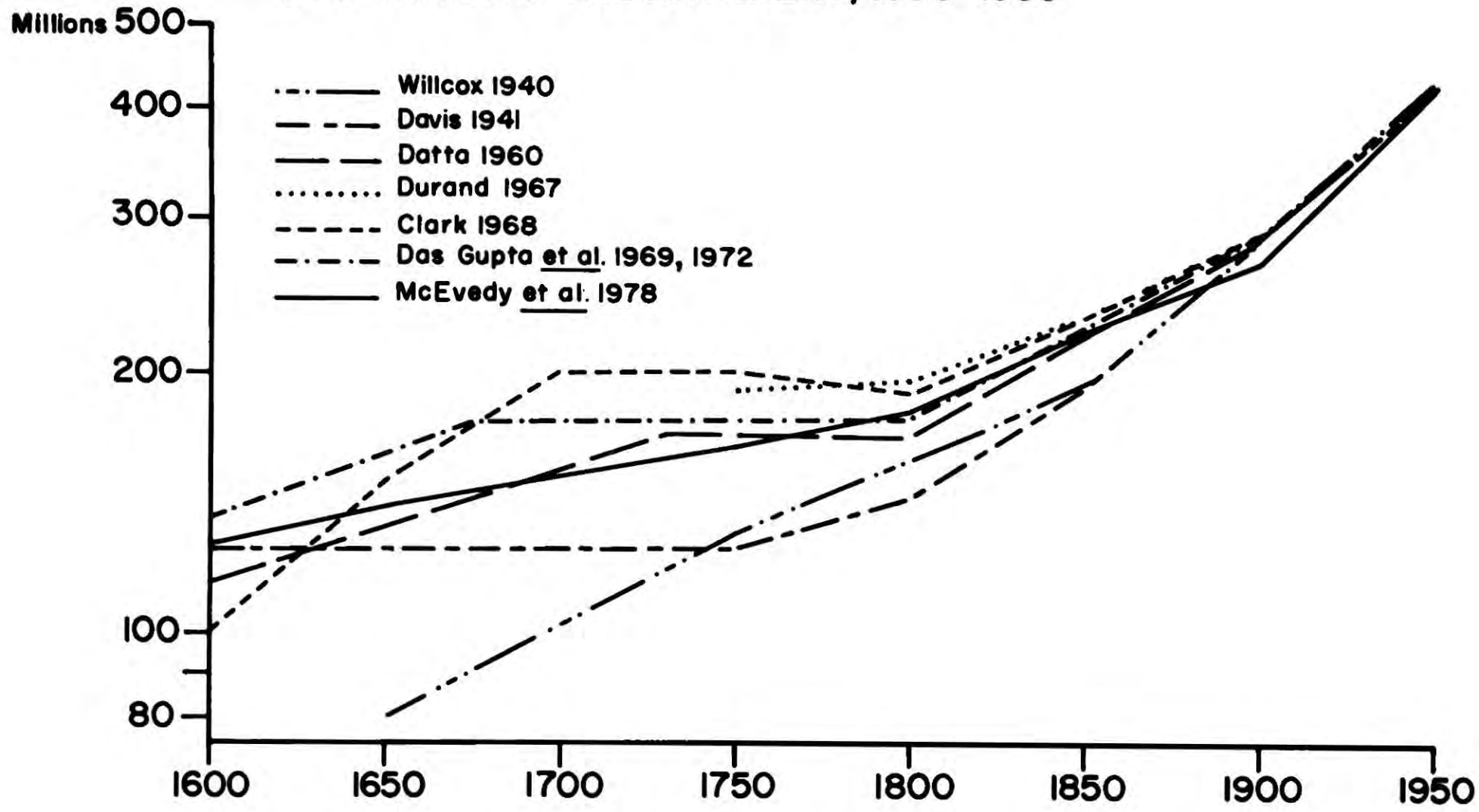
a for 14 AD b for 350 AD

SOURCES :
1. McEvedy and Jones (1978)
2. Zelinsky et al (1970)
3. Davis (1951)
4. Clark (1967)
5. Clarke (1971)

for about two millennia, the region's population experienced extremely slow growth rates. The latter fact is brought home by comparing the estimates of Nath (1929) for c.300 BC and Moreland (1920) for the end of the sixteenth century. The population graph probably showed crests and troughs; rising during periods of stable rule and economic prosperity and declining with the decay of empires and the ensuing economic instability; but the overall growth was rather modest. Table 3.1 presents the subcontinent's population trends from 300 BC to the middle of the twentieth century, according to various authorities. It is clear that, according to most authors, the subcontinent maintained a population level of 100-140 million during the two millennia before British rule. In Figure 3.1 some of the population estimates for the period 1600-1950 are plotted.

In the absence of any reliable record, it is difficult to estimate the population of the Punjab or the areas of Pakistan during these early periods. However, utilizing Akbar's record of land revenue and considering the contemporary accounts of the densely and sparsely populated areas, Moreland (1920) concluded that the Middle Ganges and the Punjab contained around 40 million. Gupta (1972) on the other hand, in estimating the present India's population, excluded one sixth from the subcontinent's total. (37) Assuming that this one sixth part was further divided approximately equally between what are now Bangladesh and Pakistan, each should have, in turn, one twelfth of the subcontinent's population. Thus it is likely that Pakistan's population size was in the region of 8-11 million around 1600. Then, taking into account Punjab's advantages in terms of its fertile soil, abundant water supply and resultant economic prosperity as well as its position as the corridor between the Moghul rulers' motherland in the west and their empire in the east, it can be suggested that the Province contained the majority of this total - may be 5-6 million. Further, the Punjab contained, in 1965, about one twentieth of the subcontinent's population. If this were true around 1600 as well, and if Durand's (1965) estimate of 140 million for the subcontinent during that period was accepted, the Punjab's population could be approximately seven million during Akbar's reign.

Fig. 3·1
POPULATION ESTIMATES OF THE
INDO-PAKISTAN SUBCONTINENT, 1600-1950



SOURCES: 1. Durand (1974); 2. McEvedy et al (1978)

Throughout the seventeenth century the subcontinent's population is believed to have increased, though at a low rate. During the last years of Emperor Shahjahan's reign (1627-1658), the subcontinent is assumed to have had a population of 145 million accompanied by the continued economic upsurge. This trend of slow but gradual increase is thought to have continued during Aurangzeb's reign (1658-1707) and, despite disorders, in the later Moghul period. (38)

Aurangzeb's demise in 1707 delivered a serious blow to Muslim rule in the subcontinent. Wars of succession and palace intrigues, which had been a recurrent phenomenon at the death of almost every monarch, assumed new and alarming dimensions and became a frequent feature throughout the subsequent decades of fading Moghul grandeur. The decay of Muslim power once initiated, could not be arrested. In the wake of rapid disintegration, most serious blows were inflicted through the foreign invasions of the Persian and Afghan rulers and by the insurgent powers of Mahrattas, Sikhs and others. The process of anarchy accelerated, and the dismemberment of the Moghul Empire was hastened by a multiplication of separate dynasties in the various provinces as well as by the British penetration. As a result, the Moghul domain swiftly shrank so as to be confined at one time to a paltry few square kilometres around the capital, Delhi.

Political instability went hand in glove with economic disorganization, and wars accelerated the process, causing famines, epidemics and other disorders which resulted in heavy mortality. It may well be, therefore, that the subcontinent's population declined during the 100-150 years of the dissolution of the Moghul Empire. In addition, numerous famines are on record. Datta (1960) estimated the subcontinent's population at 162-176 million in 1801, but Durand (1967) maintains that 160 million is a "low variant", 214 million a "high variant" and 195 million a "medium variant" for the subcontinent's population in 1800. (39) Most other estimates range between 185 and 195 million. (Table 3.1). Whatever the size of population, one thing seems certain, namely that the advent of the nineteenth century proved to be a turning point in the demographic history

of the area since the population growth rates mounted sharply and never declined afterwards. Pakistan's population is estimated at 11 million in 1850.(Table 3.1) Assuming that the Punjab's share in the national total was 62 per cent, as it was at the beginning of the twentieth century, the Province could have contained some 6-7 million people in 1850.

3.2.2. The British Period (1855-1947)

Unlike all other invaders, the British entered the subcontinent from the east, from where they started establishing their power during the middle of the eighteenth century. Gradually extending their territory, they succeeded in holding the whole country in 1857. The Punjab had, however, passed into their hands on 2 April 1849, as a result of their victory over the Sikhs at two major battles in 1845-6 and 1849.

Before its annexation by the British, the Punjab had experienced one of the worst periods of its history. Being the gateway to the subcontinent, the Province had been devastated by Persian and Afghan invaders during the middle of the eighteenth century and, once it had passed out of the feeble hands of the Moghuls, became the theatre of struggles between the rising native powers especially the Sikhs and Mahrattas. Once a prosperous area, it was now reduced to a wasteland due to continued rapine and pillage. In addition, numerous calamitous famines accompanied by widespread disease had promoted a climate of chaos and confusion. During the first forty years of the nineteenth century, six famines of varying severity occurred in 1802, 1812, 1817, 1824, 1833 and 1837 which refreshed the unpleasant memories of those occurring in 1753, 1759 and 1783. The first task of the British after taking control of the Province was to restore law and order. In due course, famines were eliminated, epidemics controlled and a programme of economic development begun.

> "The first effect of European control in India was to lessen warfare and banditry and later to reduce famine and disease. Without this outside stimulus it is doubtful if India's conditions would have changed for several centuries". (40)

A useful index of the impact which restoration of internal peace had on the Province, was the fall in foodgrain prices. The wheat price registered a decline of 28 per cent and that of grams 37.5 per cent, between 1846-50 and 1851-5.(41)

As explained in Section 1.6.1, census activity in the Punjab began in 1855 which, initially rather an arbitrary event, assumed the form of a regular decennial feature a quarter of a century later. The population of British Punjab according to different censuses is presented in Table 3.2 and charted in Figure 3.2. An account of population growth in the Province is now given for various intercensal periods.

1855-1868

The first population count held on the 1 January 1855 revealed that the British Territory in the undivided Punjab had a population of 13.8 million, which rose to 15.8 million by 1868, a growth of 14.1 per cent at an average annual rate of just below one per cent. This rate was regarded as moderately high, compared with the contemporary rates of 2.9 per cent of the USA, 1.1 per cent of the UK, 1.1 per cent of Germany and 1.2 per cent of the Netherlands. (42)

Systematic collection of economic statistics in the Punjab began in 1868. Due to the lack of such statistics prior to that date a quantitative analysis of population change vis-a-vis economic development is not possible. However, the general pattern of economic progress facilitates an explanation of population growth. The industrial sector was virtually non-existent, and agriculture was then the only source of economy upon which the whole population subsisted, directly and indirectly. A dominant part of the Province being arid or semi-arid and the modern means of irrigation almost absent, cultivation was almost entirely dependent on rain. Thus, rain was the key index of economic development.

> "Failure of rain at once attacks the means of existence of some three quarters of the population, while another tenth, dwellers in towns, suffer from the smallest rise in prices and are peculiarly liable to epidemic disease." (43)

The Province's economic prosperity was, therefore, affected by the variations

TABLE 3.2 POPULATION GROWTH IN BRITISH (UNDIVIDED) PUNJAB, 1855-1941

Census Year	British Territory				Native States				Punjab Province			
	Population 000	Inter-censal change 000	%	Annual %	Population 000	Inter-censal change 000	%	Annual %	Population 000	Inter-censal change 000	%	Annual %
1855	13,844	-	-	-	3,751	-	-	-	-	-	-	-
1868	15,799	+1,955	14.1	1.0	-	-	-	-	-	-	-	-
1881	16,939	+1,140	7.2	0.5	3,862	-	-	-	20,801	-	-	-
1891	18,653	+1,714	10.1	1.0	4,263	+401	10.4	1.0	22,916	+2,115	10.2	1.0
1901	19,943	+1,290	6.9	0.7	4,424	+161	3.8	0.4	24,367	+1,451	6.3	0.6
1911	19,579	- 364	-1.8	-0.2	4,213	-211	-4.8	-0.5	23,792	- 575	-2.4	-0.2
1921	20,685	+1,106	5.7	0.5	4,416	+203	4.8	0.5	25,101	+1,309	5.5	0.5
1931	23,581	+2,896	14.0	1.3	4,910	+494	11.2	1.1	28,491	+3,390	13.5	1.3
1941	28,419	+4,838	20.5	1.9	5,891	+981	20.0	1.8	34,310	+5,819	20.4	1.9

NOTE : Minor discrepancies due to rounding of figures.

SOURCES: computed from: 1. Census of India 1931 (vol. XVII)
2. Census of India 1941 (vol. VI)

in rainfall. When scarcity of rain produced famine conditions in one part of the Province, the poor means of transport would not permit a quick transfer of food from other parts. Thus, most famines became calamitous, taking a great toll of human life. Development of irrigation to reduce dependence on rain, and construction and modernization of the means of transport, therefore, became the focus of attention for successive administrations.

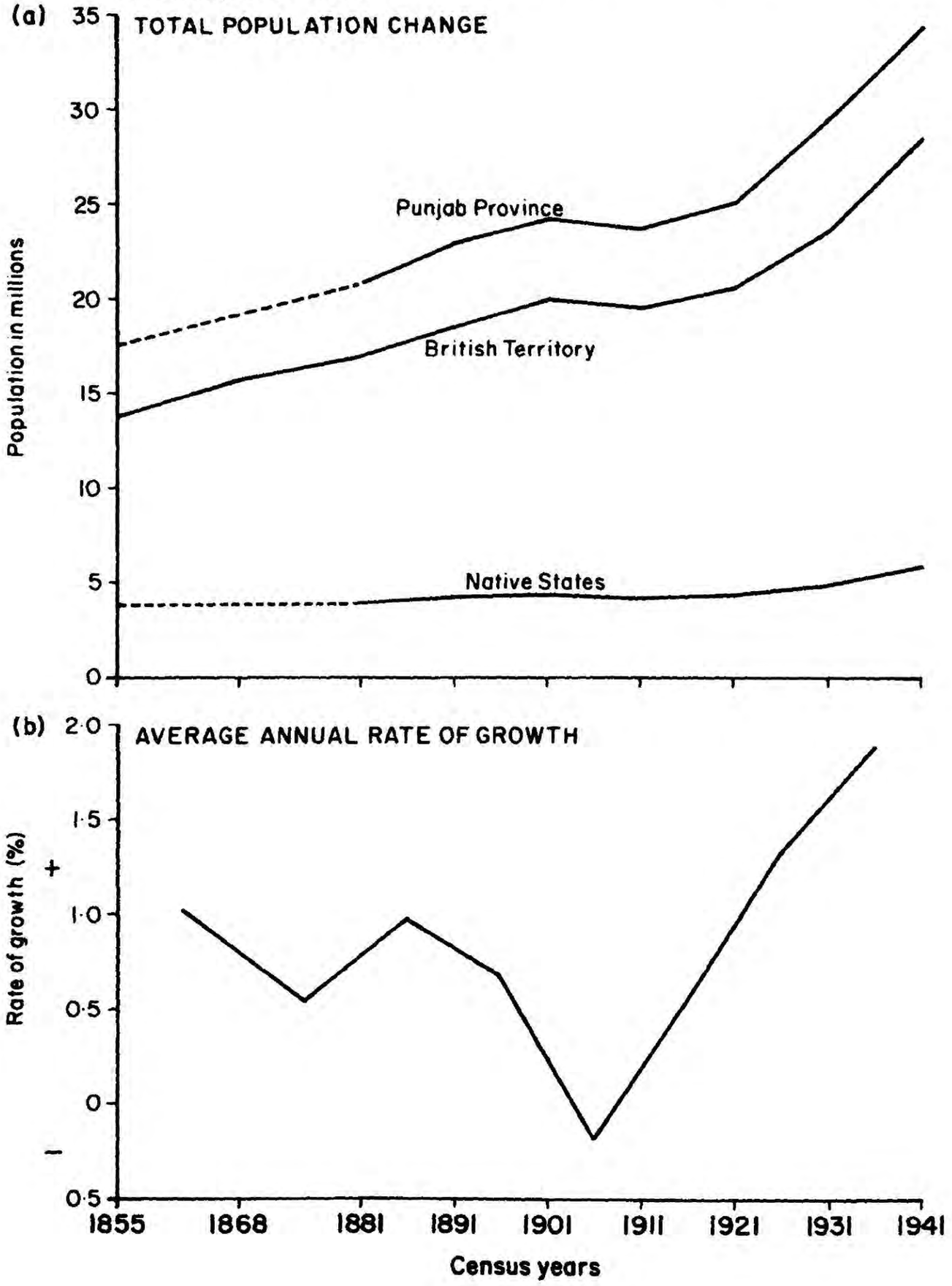
The period 1855-68 was relatively favourable for population growth since most years were untroubled by calamities and pestilence, except 1860 and 1867, the years of famine and cholera respectively. In the economic field, the Upper Bari Doab Canal, which had been started in 1850, was completed and 180 km. of it opened in 1859, and by 1869 it was irrigating 122,000 ha. In addition, due to the expansion of the inherited inundation canal system in the Province's western part another 228,000 ha. of agricultural area was under irrigation by these canals in 1869. As a result, the cultivated area increased by 32 per cent between 1855 and 1868. In an attempt to improve the transport network, construction of the first railway started in 1858 and its Lahore-Amritsar section (51 km.) was opened in 1862 and Lahore-Multan (335 km.) in 1865. This appreciable degree of economic development was conducive to a steady population growth.

1868-1881

Between 1868 and 1881 the British Territory increased its population by 7.2 per cent at an average annual rate of over 0.5 per cent. This growth rate was little more than half of that experienced during the previous intercensal period. Although more economic progress was experienced during this period, a higher mortality due to famine, fever, smallpox and cholera epidemics was responsible for slashing the population growth.

The period 1868-81 experienced an increase of 16 per cent in the cultivated and 19 per cent in the irrigated areas. The canal irrigated area rose by 41.9 per cent, reducing further the dependence of agriculture on rainfall. However, the irrigated area still formed a small fraction of the cultivated, and rain continued

Fig. 3·2
EVOLUTION OF POPULATION IN THE BRITISH (UNDIVIDED) PUNJAB, 1855–1941



to be a deciding factor in crop production. Failure of rain caused extremely difficult conditions in 1869 and 1877 and the resulting famines and accompanied widespread pestilence contributed to high mortality. The total deaths recorded during the period 1868-81 were about six million, at an annual average of 437,000, of which fever epidemic alone claimed about 65 per cent, followed by smallpox - 6 per cent. (44)

There were two distinct periods of high mortality. In 1869, the Punjab's mortality rate based on the recorded deaths, rose to 26 per thousand from 15 in 1868. It declined to 18 in 1874 but climbed to 36 in 1878 and 38 in the following year. The Province's average death rate during the period 1868-81 was 25 per thousand,while in the municipal towns with better registration it was 38. The birth rate in the urban localities was 34 which means the population of urban places actually declined. Thus the advantages of development in agriculture, roads and railways and improvements in the health facilities were largely offset by the calamities. The rate of population growth during the period 1868-81 was, therefore, much less than in the previous intercensal period.

1881-1891

Between 1881 and 1891, the population of the British Territory rose by 10.1 per cent at an average annual rate of almost one per cent. (Table 3.2). These rates were higher than those of the previous period. The Native States, which had been brought within the fold of census operation, showed a slightly higher growth rate, 10.4 per cent.

The period 1881-91 was free of famines and was characterized by a moderate degree of economic and social progress. In addition to the development and extension of existing inundation canals, the Sidhnai Canal was completed in 1886. This brought about 72,000 ha. of wasteland in Multan district under irrigation which was colonized with immigrants from the neighbouring countryside. (45) The Province's total canal irrigated area rose by almost 55 per cent during this period and the cultivated area by 11 per cent. In the absence of any major catastrophe and

with a moderate economic progress, the period 1881-91 witnessed a moderate population growth, higher than the preceding period.

1891-1901

The rate of population growth during this period dropped to 6.9 per cent in the British Territory and 3.8 in the Native States. The Lower Chenab Canal first opened as an inundation canal in 1887-88, was subsequently commissioned as a perennial system in 1892. It irrigated vast tracts of hitherto uncultivated wasteland in Lyallpur, Gujranwala, Sheikhupura and Jhang districts, together called the "Chenab Colony". The system was constantly improved and enlarged so that in 1899, out of 445,000 ha. of Chenab Colony's cultivated area, 442,000 ha. or 99.3 per cent was irrigated by the Lower Chenab Canal.

In the British Territory the main canal length rose by 13.3 per cent(6,567 to 7,442 km), and the length of canal distributaries by 49.5 per cent (12,427 to 18,583 km) during the period 1890-1900. (46) As a result, the canal irrigated area increased by almost 66 per cent and the total cultivated by 7 per cent. In addition, the period 1891-1901 was marked by the absence of any famine. South-eastern districts experienced great food shortages but the improved means of transport helped in transferring food to these areas from the food-surplus canal irrigated districts. Health conditions remained generally good, except in 1892 and 1900 when cholera and fever caused a high death rate. These events, together with a better registration were responsible for a higher recorded death rate than in the previous period.

A striking event of the last decade of the nineteenth century was the initiation of the process of colonization. As indicated in Section 2.6, canal irrigation was not new to the region for it had been in practice since the Moghul days. However, most of the population had remained concentrated in the humid parts of the Province or in the riverine tracts. This centuries-old pattern of population distribution underwent a change with the introduction of modern canals and the resulting colonization of the hitherto uncultivated land. Initially the

experiment of colonization was carried out on a limited scale in the Multan district with the opening of the Sidhnai Canal (1886) where it proved a qualified success since a perennial water supply could not be maintained.

With the opening of the Lower Chenab Canal (1892), however, the experiment was repeated on a much larger scale which proved a brilliant success and sowed the seeds for a revolution in the Punjab's economy. This, in fact, paved the way for the execution of similar projects on the region's other rivers. The development of irrigation and the accompanying colonization played a key role not only in economic progress but also in population redistribution in the Province, in succeeding decades. Distribution of land in the newly irrigated tracts to the people of the congested districts led to large scale migration and thus had a great bearing on the regional differences of population density, growth and structure.

As Table 3.3 indicates, the opening of the Sidhnai Colony in Multan district provided an incentive for in-migration. The total numbers of in-migrants were 33,700 and 38,600 at the time of the 1891 and 1901 censuses respectively, which made up 5.4 and 5.5 per cent of the total district population in the two years respectively. On both occasions, the neighbouring district Jhang provided an overwhelming proportion of the in-migrants, 73.6 and 66.1 per cent respectively. The Colony itself occupied a small area of the newly irrigated land and, being fairly well populated by local tenants before the introduction of irrigation, did not offer much incentive for the people to move from distant districts. The envisaged plan to relieve the northeastern districts of stringent population pressure, therefore, could not be redeemed (Section 4.4).

The Chenab Colony, on the other hand, offered a vast scope for in-migration from distant as well as from neighbouring districts and, as Table 3.4 indicates, an overwhelming share of its in-migrants in 1901 as well as in 1911 came from the distant, congested districts of the Province. In addition, the volume of in-migration in the case of the Chenab Colony was much higher - more than eleven times that of the Sidhnai Colony.

TABLE 3.3 IN-MIGRANTS TO MULTAN DISTRICT DUE TO THE SIDHNAI CANAL COLONY

District of Origin	Number of in-migrants (000)	
	1891	1901
Amritsar*	2.2	3.9
Sialkot	1.5	2.5
Lahore	3.7	5.1
Gujranwala	1.5	1.6
Jhang	24.8	25.5
TOTAL	33.7	38.6

* Now in India

SOURCES : 1. Census of India 1891 (vol.XIX)
2. Census of India 1901 (vol.XVII)

1901-11

The year 1901 marks a turning point in the present inquiry because since then population figures adjusted to the areas of the present study and Pakistan are available. These, together with the intercensal growth rates, are presented in Table 3.5 and charted in Figure 3.3. Population data for the Punjab's divisions and districts, true to their present boundaries, are also available since 1901 and are presented along with the intercensal growth rates in Table 3.6. Thus, for the post-1901 period, the main focus in the present analysis will be the Punjab (Pakistan). However, frequent references will be made to British (Undivided) Punjab, for the sake of comparison. Population data presented in Table 3.6 for the Punjab's districts are mapped in Figure 3.4 while Figure 3.5 provides a graphic view of the average annual growth rate experienced by the Province's divisions, during various intercensal periods since 1901.

Development of irrigation continued during the period 1901-11. As a result, there were increases of 44.5, 6.0 and 1.8 per cent in the canal irrigated, total irrigated and total cultivated areas respectively in the British Territory. Road and railway lengths rose by 32 and 26 per cent respectively. However, despite a moderate economic progress, the period 1901-11 closed with an excess of deaths over births due to widespread disease. First, a plague epidemic took a heavy toll and then, coupled with a particularly virulent form of malaria, it contributed to a death rate which remained in excess of the birth rate throughout the period except in 1906, 1909, and 1910. Cholera and smallpox also contributed to the high mortality and out of the total 9 million deaths in the British Territory during the period 1901-11, 51 per cent were caused by fever, 23 per cent by plague and almost 2 per cent by cholera and smallpox. (47)

Average birth and death rates in the British Territory had been 41.5 and 34.5 per thousand during the period 1891-1901. The succeeding intercensal period opened with a higher death rate and a lower birth rate and, although the birth rate fluctuated between 35 and 43, death rate jumped to 44 in 1902, 49 in

TABLE 3.4 IN-MIGRANTS TO THE LOWER CHENAB COLONY

District of Origin	Number of In-Migrants (000)	
	1901	1911
Amritsar*	68.0	81.2
Jullundhar*	57.0	70.9
Gurdaspur*	43.6	52.7
Hoshiarpur*	35.1	44.2
Ludhiana*	17.8	28.3
Hissar*	1.8	-
Ambala*	8.6	17.3
Ferozepur*	15.1	10.8
Patiala*	4.3	8.3
Kapurthala*	4.0	8.1
Sialkot	103.4	97.0
Lahore	28.6	28.2
Gujrat	25.4	25.2
Sargodha	16.2	12.4
Multan	7.8	12.7
Jhelum	4.2	-
Rawalpindi	1.7	-
Mianwali	-	5.9
Sahiwal	-	68.6
Bahawalpur	1.1	-
Other provinces	-	7.8
TOTAL	443.7	579.6

* Now in India - Not available

SOURCES : 1. Census of India 1901 (vol.XVII)

2. Census of India 1911 (vol.XIV)

1903 and over 62 per thousand in 1907. The excess of deaths over births during the period 1901-11 was almost 558,000. Loss of female lives was especially high and caused a distortion of sex ratio. As a consequence of this abnormally high mortality, British Punjab showed, for the first time, an actual decrease in its population, at an average annual rate of 0.2 per cent; the decrease was sharper in the Native States (Table 3.2). However, the parts more severely hit by the epidemics were mainly the eastern and the central districts. The drier western part escaped the scourge of plague and also suffered less from fevers. Therefore, whereas the undivided Punjab showed a negative population change, the areas constituting Pakistan experienced an intercensal growth of 16.9 per cent (Table 3.5).

As Table 3.6 shows, the Punjab's population rose from 10,314,090 to 10,990,580 between 1901 and 1911, at an average annual growth rate of over 0.6 per cent. At the divisional level, only Lahore showed a decrease - 6.2 per cent, but at the district level, Gujranwala showed the largest decrease (18.1 per cent), followed by Sialkot (7.3), Rawalpindi (1.9) and Gujrat (0.5). The highest increases were experienced by Sargodha (32.1 per cent), Jhang (23.1), Lyallpur (42.7) and Multan (14.5) (Fig. 3.6(a)) In the first two districts this was mainly due to in-migration as a result of irrigation introduced through the Lower Jhelum Canal (1901) which irrigated 302,000 ha. in the Sargodha, Gujrat and Jhang districts. The increase in Lyallpur and Multan districts was, however, associated with the consolidation and development of the existing irrigation network. These four districts, with healthier and more prosperous conditions, had a total increase of over 607,000 - about 90 per cent of the Punjab's total population increase. Lyallpur's example is most striking as regards the intensity of in-migration. Until 1891, the district population was only 46,926 which had actually declined by 12.8 per cent since 1881. By 1901, the population had swelled to 586,009 - an intercensal increase of 1,149 per cent.

Agricultural statistics for the period under discussion are not available

TABLE 3.5

POPULATION GROWTH IN PAKISTAN AND THE PUNJAB, 1901-72

Census Year	PAKISTAN				PUNJAB				
	Population	Intercensal Change			Population	Share of Pakistan	Intercensal Change		
	000	000	%	Av.Ann. Rate %	000	%	000	%	Av.Ann. Rate %
1901	16,577	-	-	-	10,314	62.2	-	-	-
1911	19,382	+2,805	16.9	1.6	10,991	56.7	+677	6.6	0.6
1921	21,109	+1,727	8.9	0.9	11,760	55.7	+769	7.0	0.7
1931	23,542	+2,433	11.5	1.1	13,875	58.9	+2,115	18.0	1.7
1941	28,282	+4,740	20.1	1.9	17,168	60.7	+3,293	23.7	2.2
1951	33,499*[1]	+5,217	18.5	1.7	20,651	61.7	+3,483	20.3	1.9
1961	42,906*[2]	+9,407	28.1	2.5	25,488	59.4	+4,837	23.4	2.1
1972	65,309	+22,403	52.2	3.7*[3]	37,610	57.6	+12,122	47.6	3.4

*[1] Revised to 33,780,000 after adjustment for 5 per cent underenumeration of urban population and including 13,000 of Gwadar, not part of Pakistan in 1951; and 24,000 of frontier regions, not included in the 1951 census published data. (Pakistan Statistical Yearbook 1968) - Revised to 36,180,000 by the Planning Commission (Pakistan Economic Survey 1977-78)

*[2] Revised to 46,200,000 by the Planning Commission, for 7.5 per cent underenumeration in the 1961 census. (Pakistan Economic Survey 1977-78)

*[3] The rate is 2.9 per cent if adjustment for 7.5 per cent underenumeration in the 1961 census is made; and the intercensal period 1961-72 is taken as 12 years instead of the actual 11 years and 8 months.

SOURCES : computed from 1. Census of Pakistan 1951
2. District Census Reports 1972 (52 vols.)

Fig.33
GROWTH OF POPULATION IN PAKISTAN AND THE PUNJAB, 1901 – 72

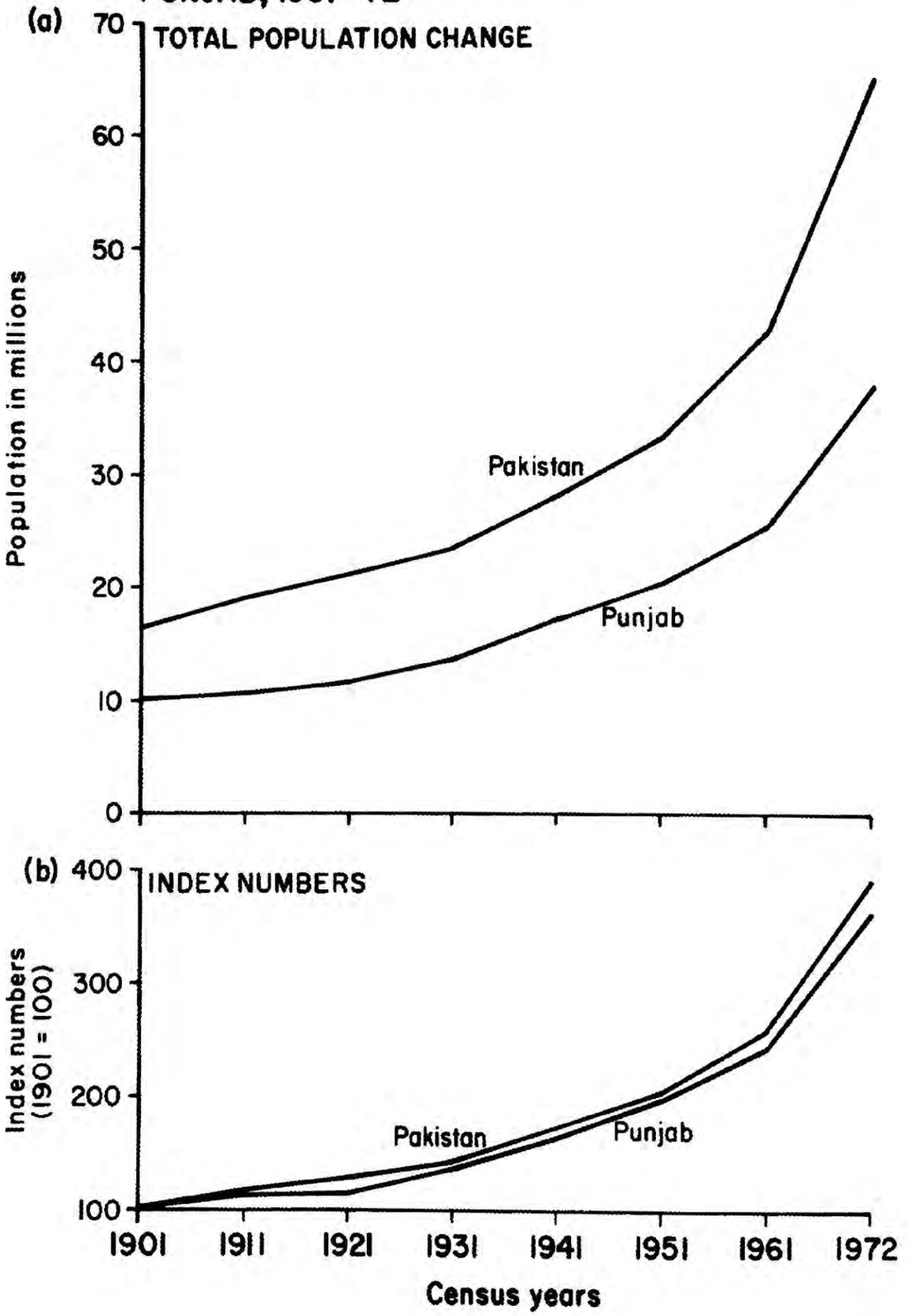


TABLE 3.6 POPULATION GROWTH IN THE PUNJAB BY DIVISIONS AND DISTRICTS, 1901-72

Territory	1901 Population	1911 Population	1911 Change No.	1911 Change %	1921 Population	1921 Change No.	1921 Change %	1931 Population	1931 Change No.	1931 Change %	1941 Population	1941 Change No.	1941 Change %	1951 Population	1951 Change No.	1951 Change %	1961 Population	1961 Change No.	1961 Change %	1972 Population	1972 Change No.	1972 Change %	Overall Change (%) 1901-51	1951-72	1901-72
RWP DIV	2316712	2366674	49962	2.2	2382587	15913	0.7	2681820	299233	12.6	3195716	513896	19.2	3439364	243648	7.6	3885025	445661	13.0	5680461	1795436	46.2	48.5	65.2	145.2
RWP	558699	547827	-10872	-1.9	569224	21397	3.9	634357	65133	11.4	785231	150874	23.8	908327	123096	15.7	1109453	201126	22.1	1747685	638232	57.5	62.6	92.4	212.8
CPR	464430	519273	54843	11.8	512249	-7024	-1.4	583960	71711	14.0	675875	91915	15.7	690301	14426	2.1	700331	10030	1.5	981734	281403	40.2	48.6	42.2	111.4
JLM	501424	511575	10151	2.0	477068	-34507	-6.7	541076	64008	13.4	629658	88582	16.4	682061	52403	8.3	749229	67168	9.8	1051864	302635	40.4	36.0	54.2	109.8
GJT	792159	787999	-4160	-0.5	824046	36047	4.6	922427	98381	11.9	1104952	182525	19.8	1158675	53723	4.9	1326012	167337	14.4	1899178	573166	43.2	46.3	63.9	139.7
SRG DIV	1802293	2347553	545260	30.3	2616745	269192	11.5	3064564	447819	17.1	3723178	658614	21.5	4743111	1019933	27.4	5976939	1233828	26.0	8999378	3022439	50.6	163.2	89.7	399.3
SRG	488149	645001	156852	32.1	719918	74917	11.6	821490	101572	14.1	998921	177431	21.6	1162988	164067	16.4	1467621	304633	26.2	2100955	633334	43.2	138.2	80.7	330.4
MWI	301910	341377	39467	13.1	358205	16828	4.9	411539	53334	14.9	506321	94782	23.0	550499	44178	8.7	746733	196234	35.6	1095632	348899	46.7	82.3	99.0	262.9
JNG	426225	524803	98578	23.1	570559	45756	8.7	664833	94274	16.5	821631	156798	23.6	876761	55130	6.7	1078747	201986	23.0	1561006	482259	44.7	105.7	78.0	266.2
LYP	586009	836372	250363	42.7	968063	131691	15.7	1166702	198639	20.5	1396305	229603	19.7	2152863	756558	54.2	2683838	530975	24.7	4241785	1557947	58.0	267.4	97.0	623.8
LHR DIV	3320753	3114384	-206369	-6.2	3358523	236139	7.6	3872459	521936	15.6	4759784	887325	22.9	5339873	580089	12.2	6448575	1108702	20.8	9834836	3386261	52.5	60.8	84.2	196.2
LHR	890238	886388	-3850	-0.4	1001956	115568	13.0	1212974	211018	21.1	1513040	300066	24.7	1895228	382188	25.3	2479687	584459	30.8	3774007	1294320	52.2	112.9	99.1	323.9
SLT	1167670	1082097	-85573	-7.3	1090716	8619	0.8	1226980	136264	12.5	1482002	255022	20.8	1474253	-7749	-0.5	1596383	122130	8.3	2343925	747542	46.8	26.3	59.0	100.7
GWA	739546	605582	-133964	-18.1	623581	17999	3.0	736138	112557	18.1	912234	176096	23.9	1047032	134798	14.8	1291886	244854	23.4	2059755	767869	59.4	41.6	96.7	178.5
SHA	523299	540317	17018	3.3	634270	93953	17.4	696367	62097	9.8	852508	156141	22.4	923360	70852	8.3	1080619	157259	17.0	1657149	576530	53.4	76.4	79.5	216.7
MTN DIV	2153455	2381328	227873	10.6	2629124	247796	10.4	3271382	642258	24.4	4147881	876499	26.8	5305667	1157786	27.9	6602924	1297257	24.5	9551688	2948764	44.7	146.4	80.0	343.6
MTN	700227	801455	101228	14.5	879146	77691	9.7	1159549	280403	31.9	1484333	324784	28.0	2107603	623270	42.0	2702354	594751	28.2	4007456	1305102	48.3	201.0	90.1	472.3
SWL	429674	481965	52291	12.2	685690	203725	42.3	999772	314082	45.8	1329103	329331	32.9	1816120	487017	36.6	2134072	317952	17.5	2836889	702817	32.9	322.7	56.2	560.2
MZG	527681	569461	41780	7.9	568478	-983	-0.2	591375	22897	4.0	712849	121474	20.5	751250	38401	5.4	989878	238628	31.8	1564895	575017	58.1	42.4	108.3	196.6
DGK	495873	528447	32574	6.6	495810	-32637	-6.2	520686	24876	5.0	621596	100910	19.4	630694	9098	1.5	776620	145926	23.1	1142448	365828	47.1	27.2	81.1	130.4
BWP DIV	720877	780641	59764	8.3	781191	550	0.1	984612	203421	26.0	1341209	356597	36.2	1823125	481916	35.9	2574066	750941	41.2	3543796	969730	37.7	152.9	94.4	391.6
BWP	208751	226057	17306	8.3	226217	160	0.1	285124	58907	26.0	388388	103264	36.2	527942	139554	35.9	735524	207582	39.3	1071026	335502	45.6	152.9	102.9	413.1
BWN	249320	269990	20670	8.3	270180	190	0.1	340534	70354	26.0	463865	123331	36.2	630538	166673	35.9	822827	192289	30.5	1073891	251064	30.5	152.9	70.3	330.7
RYK	262806	284594	21788	8.3	284794	200	0.1	358954	74160	26.0	488956	130002	36.2	664645	175689	35.9	1015715	351070	52.8	1398879	383164	37.7	152.9	110.5	432.3
PUNJAB	10314090	10990580	676490	6.6	11760170	769590	7.0	13874837	2114667	18.0	17167768	3292931	23.7	20651140	3483372	20.3	25487529	4836389	23.4	37610159	12122630	47.6	100.2	82.1	264.7
PAKISTAN	16576593	19381532	2804939	16.9	21108779	1727247	8.9	23542071	2433292	11.5	28282064	4739993	20.1	33499462	5217398	18.5	42905571	9406109	28.1	65309340	22403769	52.2	102.1	94.9	294.0

SOURCE : Computed from District Census Reports 1972 (52 vols)

for the Bahawalpur division since it then formed a native state. However, such data are available for the rest of the Punjab and can be used to establish that the present Pakistani Punjab made greater economic progress than British Punjab as a whole. According to these statistics (Table 3.7), our area of study experienced increases of 31.9, 57.9 and 10.7 per cent in its total irrigated, canal irrigated and the total cultivated area between 1901 and 1911. These rises outclassed those of the Undivided Punjab (6.0,44.5 and 1.8 per cent respectively). This differential rate of economic progress was closely linked with the disparity of population change between the two areas.

1911-21

While the British Territory's population rose by 5.7 per cent between 1911 and 1921 (Table 3.2), Pakistani Punjab's increased by 7 per cent. This was linked with the increases of 34.8, 24.8 and 12.9 per cent respectively in the canal irrigated, total irrigated and total cultivated areas in this part (Table 3.7). The total cultivated area first increased by almost 17 per cent between 1910-11 and 1917-18 but the increase was arrested thereafter due to the widespread disease and high mortality which were more severe in the countryside and thus paralysed the agricultural labour force. As a result, the intercensal increase in the total cultivated area came down to 12.9 per cent.

Despite financial stringencies imposed by the World War I, economic progress continued, though at a considerably retarded pace. However, the intercensal period 1911-21,which had opened in rather hopeful circumstances, was marked by crop failures, price rises, economic strains and political disorders. Population growth was hampered by all these "ailments" but much more seriously by the outbreak of influenza epidemic in 1918-19 which was by no means confined to the Punjab but spread throughout the subcontinent and claimed nearly twenty million lives. As a result, the subcontinent's population remained almost stationary during the period 1911-21, the intercensal increase being a mere 0.009 per cent,whereas the present India's population actually declined by

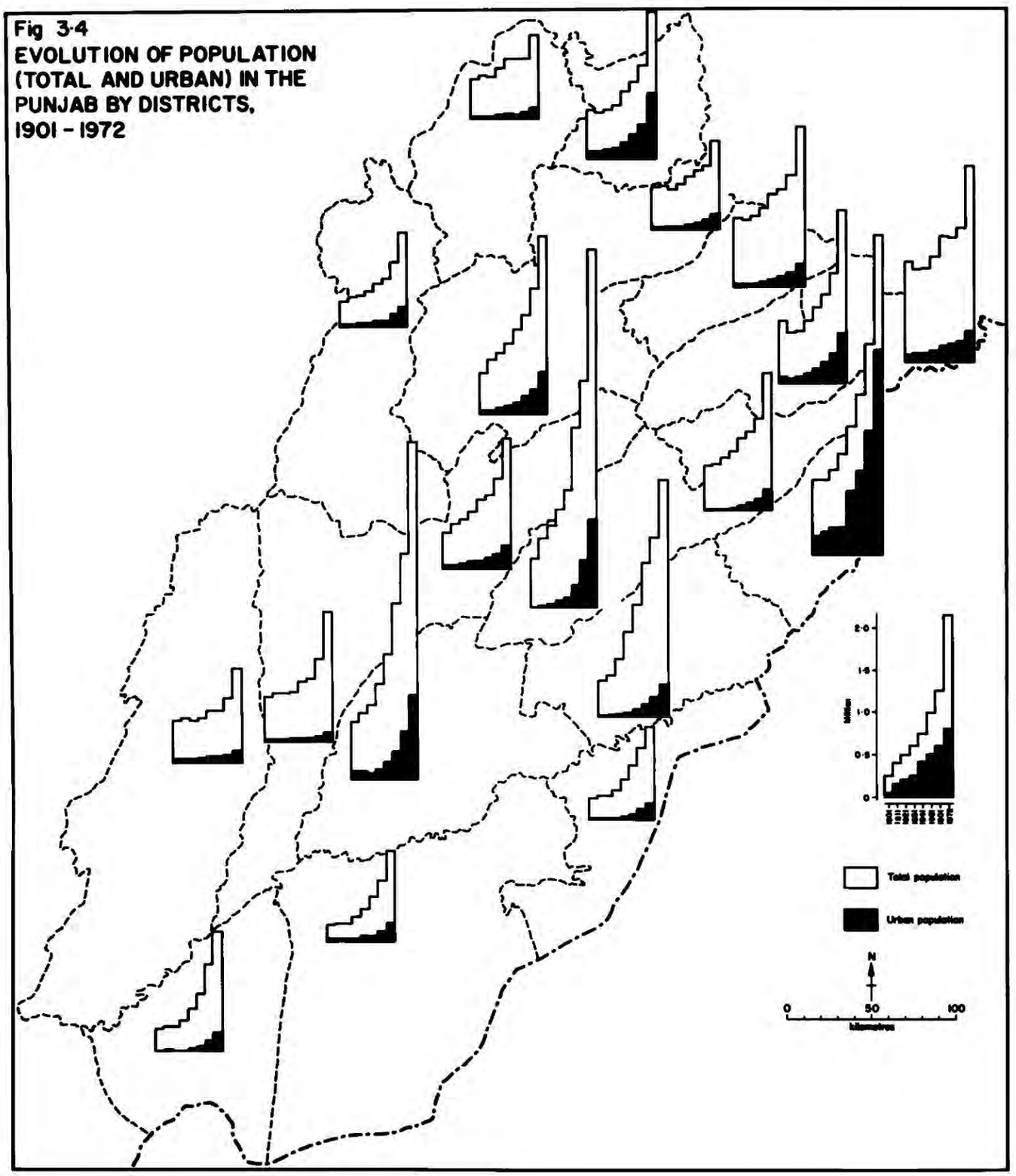


Fig 3·4
EVOLUTION OF POPULATION (TOTAL AND URBAN) IN THE PUNJAB BY DISTRICTS, 1901 - 1972
Millions
2·0
1·5
1·0
0·5
0
Total population
Urban population
N
0
50
100
kilometres

TABLE 3.7

AGRICULTURAL AREAS IN THE PUNJAB, 1901-72

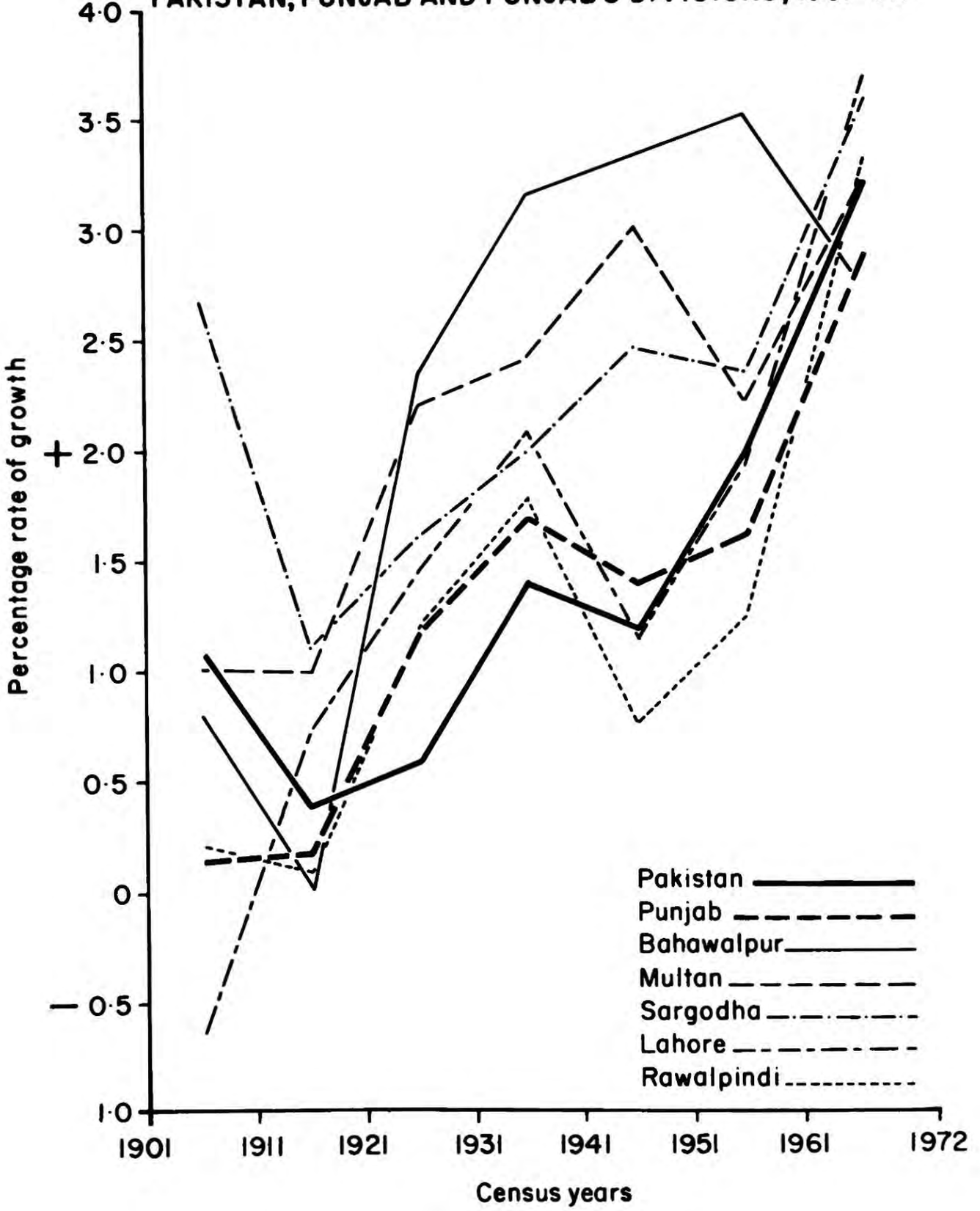
(Quinquennial Averages)

Year	Total Cultivated		Net Sown		Total Irrigated		Canal Irrigated	
	mill. ha	% change	mill. ha	% change	mill. ha	% change	mill. ha	% change
1901*	5.31	-	4.24	-	2.26	-	1.33	-
1911*	5.88	10.7	4.88	15.1	2.98	31.9	2.10	57.9
1921*	6.64	12.9	5.37	10.0	3.72	24.8	2.83	34.8
1931*	6.95	4.7	5.98	11.4	4.16	11.8	3.21	13.4
1941*	7.32	5.3	6.46	8.0	4.73	13.7	3.64	13.4
1951	9.06	23.8	7.74	19.8	5.76	21.8	4.73	29.9
1961	9.95	9.8	8.82	13.9	6.96	20.8	5.81	22.8
1972	11.12	11.8	9.93	12.6	9.18	31.9	6.41	10.3

* Data are for the Punjab's 16 districts (excluding Bahawalpur division)
This has caused an abnormal rise between 1941 and 1951.

SOURCES : computed from 1. Hassan (1950)
2. Agricultural Statistics of Pakistan 1975

Fig.3·5
AVERAGE ANNUAL RATE OF POPULATION GROWTH IN PAKISTAN, PUNJAB AND PUNJAB'S DIVISIONS, 1901–72



0.31 per cent. (48) Pakistan's population, however, experienced an increase of 8.9 per cent and the Punjab's 7 per cent. (Table 3.5)

Despite occasional small scale visitations of plague and fever during the first seven years of the period 1911-21, the CDRs in the British Territory varied between 23 and 37 and the CBRs between 41 and 43 per thousand. But the second half of the year 1918 made all the difference. The influenza epidemic, which came in numerous waves during August and September, assumed alarming proportions in October and, within a matter of few weeks, about one million deaths occurred in British Territory alone.(49) The death rate for that year jumped to 81, while the birth rate dropped to 39.6 per thousand. Thus, the average CDR for the intercensal period 1911-21 was raised to 44 per thousand and the CBR depressed to 37. As a result, the period,which had opened in a rather promising climate with a "resuscitation" from the preceding calamitous decade, closed in generally gloomy circumstances.

Despite the constraints exerted on the natural increase by a high mortality, a number of the Punjab's districts experienced high rates of population growth, mainly due to internal migration linked with the expansion of irrigation. Between 1911 and 1921, the Bari Doab districts of Sahiwal and Multan became the focus of canal irrigation. For this, the Triple Canal Project consisting of the Upper Jhelum, the Upper Chenab and the Lower Bari Doab canals, was completed in early 1917, though irrigation from these canals had started earlier. Thus not only was the surplus water of the Jhelum made available to the wasteland of the Bari Doab, but vast tracts in the arid Rechna and Chaj doabs also benefitted. The completion of these canals provided the necessary impetus for the colonization of the newly irrigated areas to which the flow of migrants continued;and the number of in-migrants to the Upper Chenab Colony and the Lower Bari Doab Colony between 1911 and 1921 was 76,500 and 74,200 respectively (Table 3.8).This indicates a major reshuffle of population in the Punjab's districts.

Figure 3.6 (b) depicts population change in the Punjab by districts between

TABLE 3.8 IN-MIGRANTS TO THE UPPER CHENAB AND LOWER BARI DOAB COLONIES, 1911-21

(000)

District of Origin	Upper Chenab*[1] Colony	Lower Bari Doab*[2] Colony
Jullundhar*	7.5	18.8
Hoshiarpur*	4.4	10.6
Amritsar *	12.1	3.1
Gurdaspur *	7.5	7.1
Ferozapur *	1.1	4.2
Hissar *	1.2	0.8
Ambala *	0.7	0.9
Ludhiana *	0.5	1.7
Sialkot	30.2	8.1
Lahore	5.2	13.6
Jhelum	0.9	1.7
Mianwali	0.3	—
Gujrat	3.1	2.1
Other districts	1.8	1.5
TOTAL	76.5	74.2

* Now in India

*[1] Mainly districts of Sheikhupura and Gujranwala

*[2] Mainly district of Sahiwal

SOURCE: Census of India 1921 (vol. XV)

1911 and 1921. While four districts : Jhelum, Dera Ghazi Khan, Campbellpur and Muzaffargarh experienced decline in their population - 6.7, 6.2, 1.4 and 0.2 per cent respectively - mainly due to out-migration, all the other district populations increased, largely because of in-migration. The largest increase was experienced by Sahiwal (42.3 per cent), because of the Lower Bari Doab colonization; followed by Sheikhupura (17.4) and Lyallpur (15.7). Together these three districts showed an increase of over 429,000 or 23.1 per cent during the period in question.

1921-31

Figure 3.2 reveals that the intercensal rates of the region's population growth had manifested a great deal of fluctuation before 1921. An alternating process of high and low rates seems to have been operative which ceased after 1921 when continuous growth occurred at an accelerating rate. The year 1921, in fact, marks a watershed in the region's population history since:

> "From 1921 the fertility and mortality patterns of the population began to vary considerably. Beginning from this decade, the government became better organized and was able to grapple effectively with the problems of drought, floods and food scarcity. It undertook suitable measures of epidemic control and treatment of common diseases, thereby avoiding calamities on a national scale." (50)

Of the three components of population change, migration has been least effective in the total population change of the subcontinent as a whole, though internal migration played a significant role in the regional disparities of population growth. Thus, the overall population change of the subcontinent as a whole rested almost exclusively upon the relative behaviour of fertility and mortality. What happened at the watershed mark of the region's demographic history was that the improvement in health conditions coupled with an increasing degree of economic progress began to cause a steady decline in the region's mortality rates. As a result, the region entered a period of rapid population growth after 1921. In the words of Tayyeb (1966):

> "It was only after 1921 that many of the changes in the economy introduced by the British Government began to be reflected in a

> changing pattern of population growth. Prominent among these were the expansion of industry, commerce, agriculture, and irrigated area, and considerable improvement in transport, hygiene and sanitary facilities. The consequent increases in the food base, and better provisions for distribution and supply of food from surplus to deficit areas also greatly reduced the impact of drought, flood and famine. As a result while the improving conditions permitted and maintained a high level of birth-rate, they appreciably depressed the death-rate - the increment rates soared." (51)

The Punjab's irrigation development and the resulting expansion of its cultivated area continued to provide a congenial climate for population expansion and redistribution in the Province. In particular, the canal colonies, with their economic prosperity, exerted a sort of "magnetism" upon the populations of other districts. As a result, the unabated influx of immigrants accentuated the already rising growth rate in the colony districts. During the 1921-31 period, over 240,000 persons out-migrated from their districts of birth to settle in the canal colonies. (52) This was a momentous movement in view of the generally sedentary nature of the region's population. Most of the in-migrants to the canal areas came from within the Province.

Although the principal cause of the spectacular population growth in the canal areas was the influx of cultivators, another important factor must not be lost sight of,viz. a stimulated natural increase. Davis (1951) found that the districts with the largest increase of agricultural area had experienced the greatest excess of births over deaths; the coefficient of correlation between the two series was +0.90. (53) Thus, the newly opened canal areas experienced a rapid population increase due both to in-migration and a high natural increase.

Migration, seemingly a simple population flow, conceals in itself numerous important currents and the Punjab's canal areas were, like any other area, exposed to the effects of these currents. The stimulated natural increase, for instance, was in part a result of the migration itself. The three areas with the highest population increase and rapid irrigation development between 1921 and 1931 - Sahiwal (45.8 per cent), Multan (31.9) and the Bahwalpur division (26.0)-had a higher proportion of women in the 15-30 age group - 31.2 per cent compared with

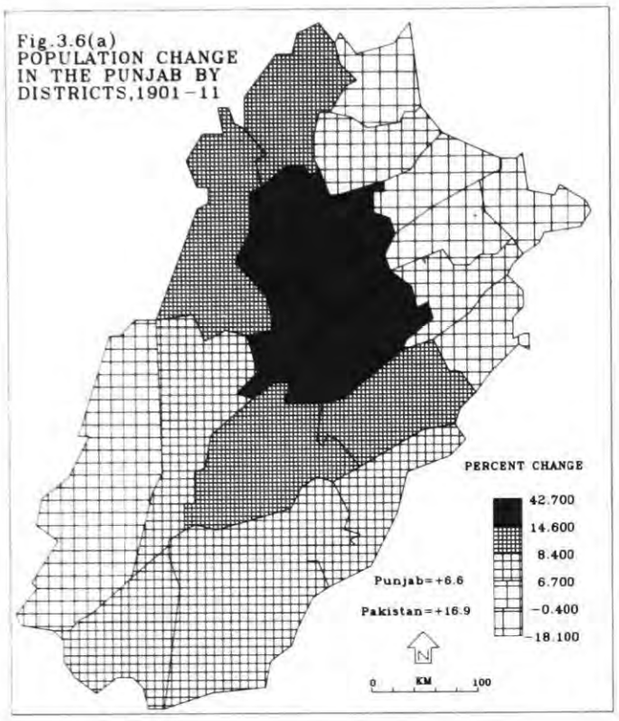


Fig.3.6(a)
POPULATION CHANGE
IN THE PUNJAB BY
DISTRICTS,1901-11
PERCENT CHANGE
42.700
14.600
8.400
6.700
-0.400
-18.100
Punjab=+6.6
Pakistan=+16.9
N
0 KM 100

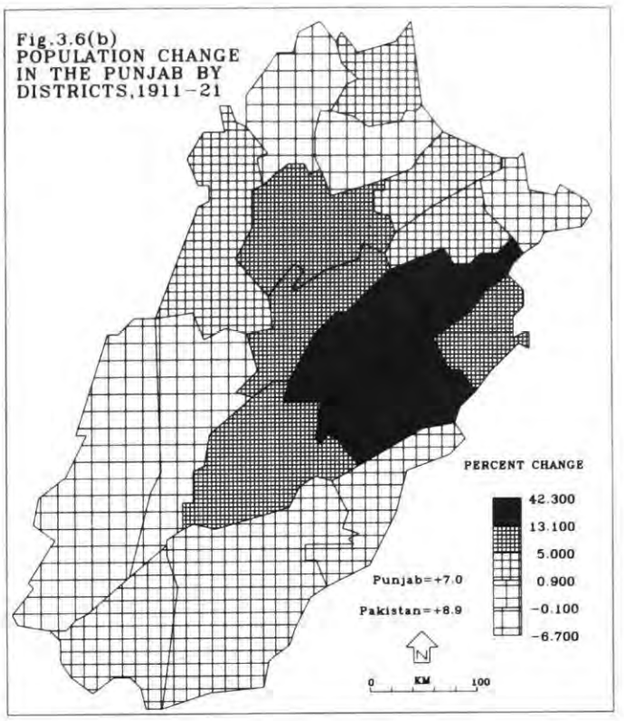


Fig.3.6(b)
POPULATION CHANGE
IN THE PUNJAB BY
DISTRICTS,1911-21
PERCENT CHANGE
42.300
13.100
5.000
0.900
-0.100
-6.700
Punjab=+7.0
Pakistan=+8.9
N
0 KM 100

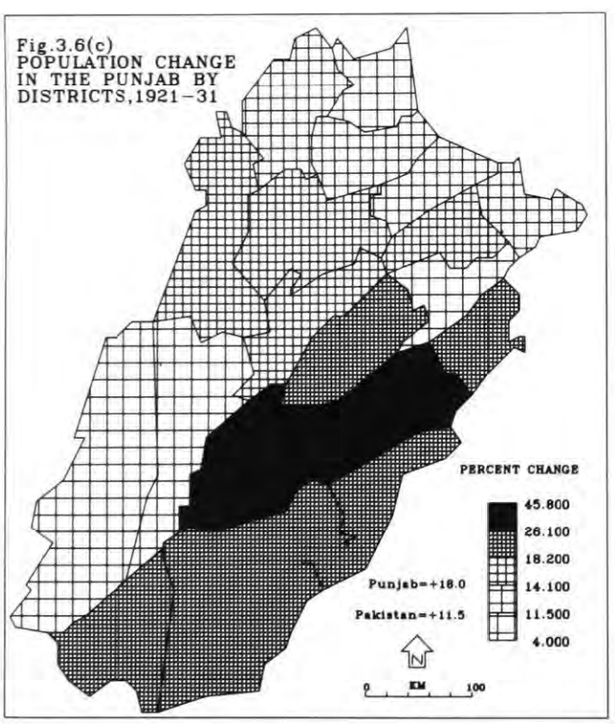


Fig.3.6(c)
POPULATION CHANGE
IN THE PUNJAB BY
DISTRICTS,1921-31
PERCENT CHANGE
45.800
26.100
18.200
14.100
11.500
4.000
Punjab=+18.0
Pakistan=+11.5
N
0 KM 100

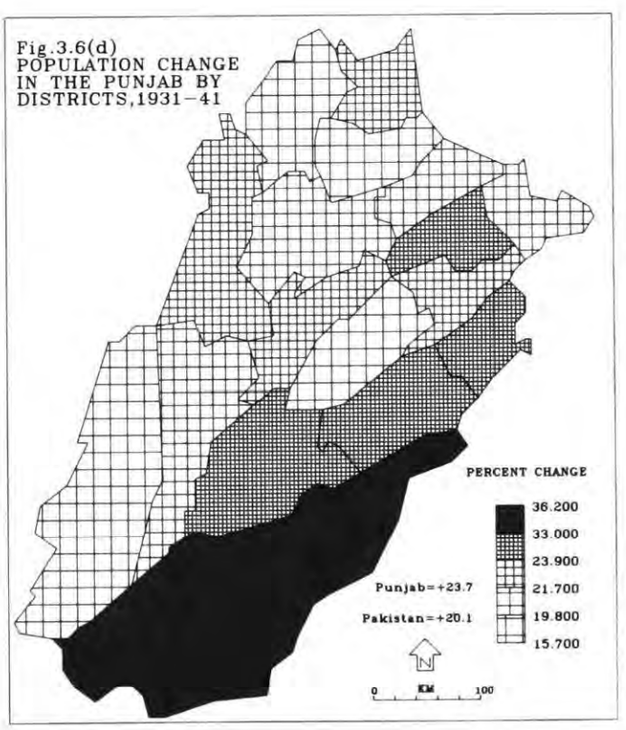


Fig.3.6(d)
POPULATION CHANGE
IN THE PUNJAB BY
DISTRICTS,1931-41
PERCENT CHANGE
36.200
33.000
23.900
21.700
19.800
15.700
Punjab=+23.7
Pakistan=+20.1
N
0 KM 100

26.4 for the rest of British Punjab. (54) It is common knowledge that the age-selectivity of migration has a great impact on the performance of fertility and mortality and usually results in a substantial natural increase; and the Punjab's canal areas were no exception to this.

As Table 3.5 shows, the Punjab increased its population at a spectacular rate of 18 per cent between 1921 and 1931. This rate was not only higher than Pakistan's (11.5) or British Punjab's (14.0) in the same period, but was the highest ever recorded in the Province's history; and could be even higher if allowance were made for underenumeration in the 1931 census (Section 1.6). As explained earlier, the mortality rates had largely been arrested and, despite the plague epidemics (1924 and 1926), the outbreak of cholera (1926 and 1928) and that of malaria (1929), the loss of life was not as high as before, because of a reorganization and a phenomenal progress made by the health and medical facilities. Between 1920 and 1930, the number of British Punjab's hospitals and dispensaries rose by 77.6 per cent from 583 to 1035; and the number of patients treated by 134 per cent from 5 to 11.7 million. (55) As a result, the average death rate declined and between 1925 and 1929, it was 29.5 per thousand from all causes, 18.7 due to fever and 1.6 to plague. Infant mortality rate, which had been above 200 during most years of the three earlier decades and had exceeded 300 per thousand in 1908, remained below 200 throughout the period 1921-1931 except in 1924 when it rose to 210.

A striking aspect of the Punjab's population growth after 1921 is that no district, except Sialkot during 1941-51, ever experienced an intercensal decline in its population. As Figure 3.6(c)depicts,the highest rates of population growth during the period 1921-31 were registered by Sahiwal (45.8 per cent) and Multan (31.9) districts and by the Bahawalpur division (26.0). This was again due to a high natural increase as well as to in-migration associated with further development and expansion of canal irrigation. In Bahawalpur division, owing to the opening of the Sutlej Valley canals and in Sahiwal and Multan, because of these

canals and also due to improvement and extension of their existing irrigation network, the colonized area further expanded to attract more in-migration. The other canal irrigated districts also showed a rapid increase and, in Lahore and Lyallpur districts, population rose by 21.1 and 20.5 per cent respectively. The lowest growth rates were shown by the dry western districts : Muzaffargarh (4 per cent) and Dera Ghazi Khan (5);and also by Sheikhupura (9.8). The last mentioned, despite being a canal irrigated area, showed a slow rate of growth since it lost some of its early colonists to other colonies which proved more attractive with their better economic conditions.

1931-41

The last two censuses of the British period were held in a climate of communal tension. As the struggle for independence intensified, communal conflict between the Hindus and Muslims escalated. The Muslims' demand for Pakistan led to a communal conflict of enormous proportions. The resulting turmoil often paralysed law and order and also cast its shadow on the census operations of 1931 and 1941. (Section 1.6)

Communal frenzy mounted throughout the period 1931-41 and became particularly intense after the passage of the Pakistan Resolution in 1940. The 1941 census was thus conducted in an atmosphere of enormous turmoil. With an increased degree of political consciousness, especially in the urban areas, the various communities vied with each other to exaggerate their numbers through bogus and multiple entries. In these circumstances, scepticism concerning the accuracy of the 1941 census data is not unfounded. However, the period 1931-41 is believed to have experienced a rapid population increase.

The Punjab experienced a population increase of over 23.7 per cent between 1931 and 1941, at an average annual rate of almost 2.2 per cent. As in the previous decade, these rates were higher than those of Pakistan (20.1 and 1.9 per cent) and British Punjab (20.5 and 1.9). However, these rates could be

slightly different if the true extent of underenumeration in 1931 and over-enumeration in 1941 was known.

This unprecedented growth of population was the result of a complete elimination of famine as well as the eradication of epidemics which lowered mortality and thus increased the natural rate of growth. Not less important, however, was the region's agricultural prosperity and food autarky linked with the expansion of canal irrigation. Between 1931 and 1941, the cultivated and canal irrigated area in the "Bahawalpur less" Punjab rose by 5.3 and 13.4 per cent respectively (Table 3.7);and the increase would be much higher if the agricultural statistics of the Bahawalpur division were included, since that area had been "opened" because of irrigation during the previous decade.

The Sutlej Valley canals opened between 1926 and 1928, were further developed so that the Scheme was completed in 1933, providing more water to the old as well as newly irrigated areas. In addition, the Haveli Canal Project (1937-9) was completed and water made available to the Muzaffargarh district. Additional supplies from this Project were dropped into the Ravi at Sidhnai, enabling the extension of irrigation from it in the Multan district. Interestingly enough, the general pattern of population growth underwent a significant change during the period 1931-41. Although the highest population increases in the Bahawalpur division (36.2 per cent) and the districts of Sahiwal (32.9) and Multan (28.0)followed, as before, the development of irrigation; most other districts also experienced a high population increase of nearly 20 per cent. In all, eight districts experienced higher rates than the Provincial average of 23.7 per cent - evidence of famine and pestilence control. Figure 3.6 (d) depicts population change in the Punjab by districts during the period 1931-41. A significant departure from the earlier patterns, apart from the "shift" discussed above, is that Lyallpur registered one of the lowest population increase rates since, for some time, the tide of in-migration was diverted to other colony districts.

Before we move on to discuss the Punjab's population growth in the succeeding decades, it is appropriate to take stock of growth so far, particularly in the modern census period. In brief, British Punjab's population increased slowly between 1855 and 1901, when it rose by 44 per cent in 46 years, at an average annual rate of 0.8 per cent. This slow growth was mainly due to frequent famines and widespread epidemics, periods of rapid increase alternating with periods of slow growth - a trend that exerted a sort of balance upon the population growth. However, population did not actually decline in any decade during the nineteenth century.

In the first decade of the twentieth century, on the other hand, the population of the Undivided Punjab experienced a decline because of plague and fever epidemics and famine. During the next decade (1911-21), the growth rate picked up again and a steady population increase commenced due largely to famine elimination and disease control. This trend continued in the succeeding decades (Fig. 3.2 (a) & (b)).

In the case of our area of study, irrigation expansion played a major role not only in the Province's economic and social development but also in its population growth and redistribution. Other factors, like the higher fertility and lesser susceptibility to death of the in-migrants, also played their part. In addition, the development of better means of transport and communications not only bridged the gap between the food surplus and deficit areas but also helped in the development of new towns in the colony areas which, with better sanitary and health facilities, attracted migrants from other districts.

Figure 3.7 (a) shows population change in the Punjab by districts between 1901 and 1941. Whereas the Province as a whole experienced an increase of 66.5 per cent during this period, 10 of its 19 districts showed higher increase rates; in four – Sahiwal, Lyallpur, Multan and Sargodha – the growth rates exceeded 100 per cent. Together these four districts benefitted most from the canal irrigation schemes and experienced a total increase of over 3 million or

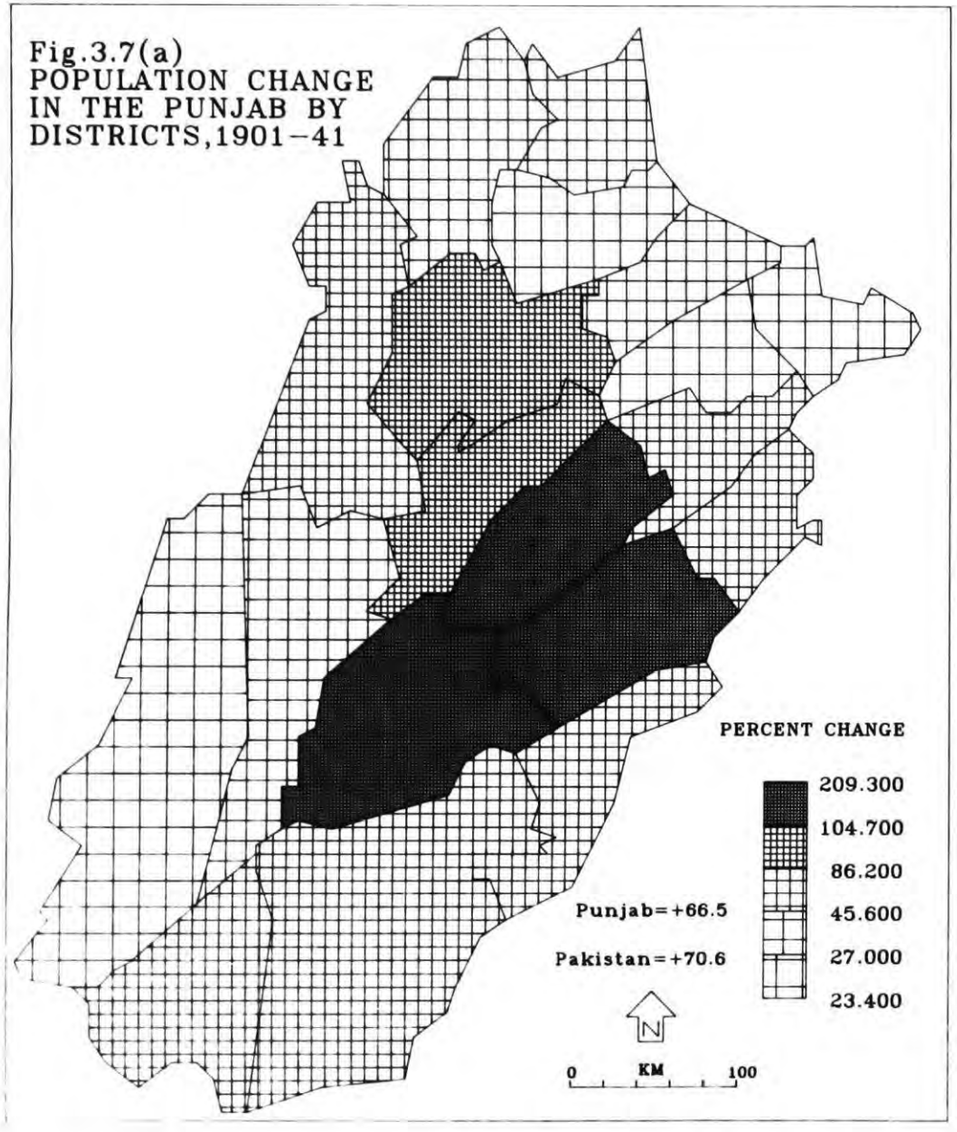


Fig.3.7(a)
POPULATION CHANGE
IN THE PUNJAB BY
DISTRICTS,1901-41
PERCENT CHANGE
209.300
104.700
86.200
45.600
27.000
23.400
Punjab=+66.5
Pakistan=+70.6
N
0
KM
100

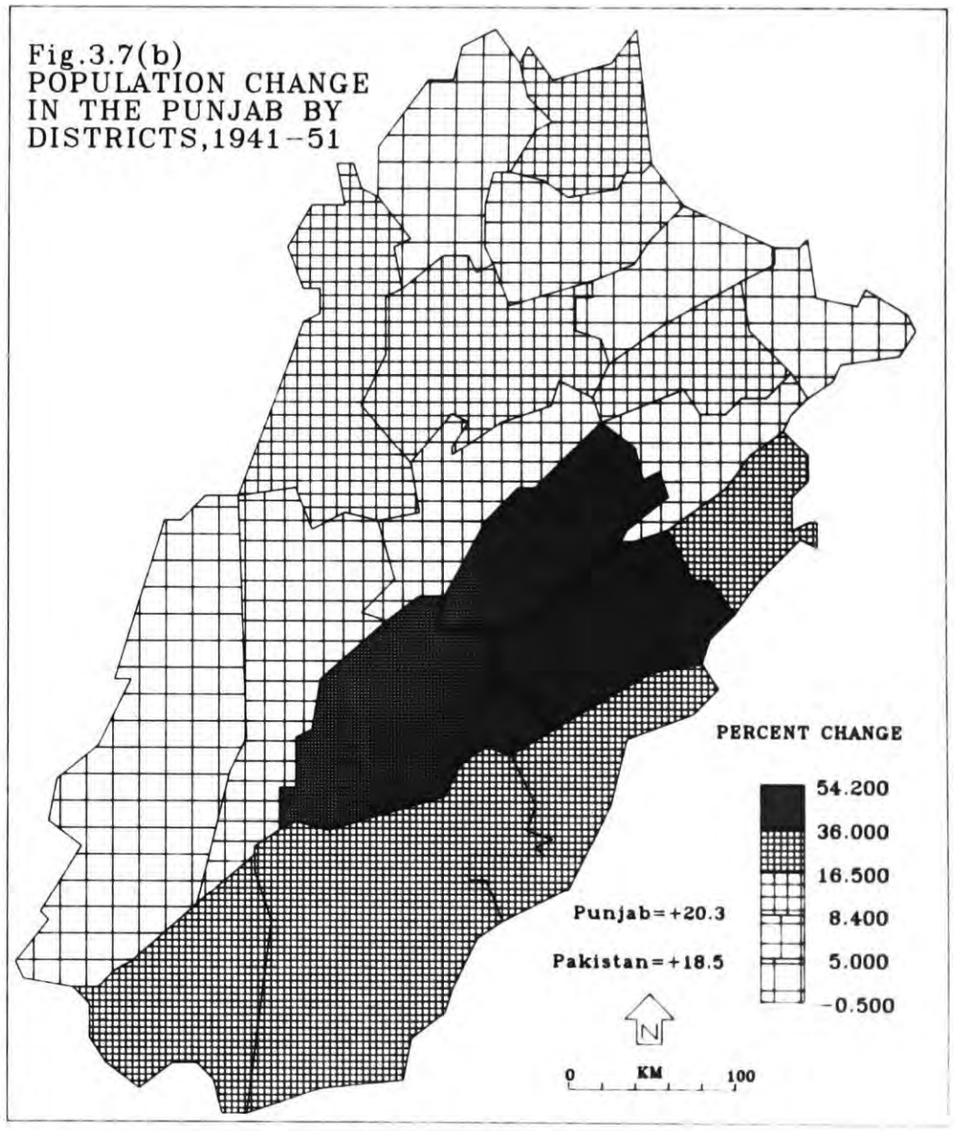


Fig.3.7(b)
POPULATION CHANGE
IN THE PUNJAB BY
DISTRICTS,1941-51
PERCENT CHANGE
54.200
36.000
16.500
8.400
5.000
-0.500
Punjab=+20.3
Pakistan=+18.5
N
0
KM
100

136 per cent during the period 1901-41, at a striking average annual rate of 2.2 per cent. In addition, Lyallpur, where colonization started a decade earlier, had registered an increase of 1,149 per cent during the period 1891-1901. The smallest rates of population increase between 1901 and 1941 were shown by Gujranwala (23.4 per cent), Dera Ghazi Khan (25.4) and Jhelum (25.6), mainly because of out-migration. But in the first mentioned it was also due to disease and high mortality especially between 1901 and 1911, while in the other two districts, food shortage and economic backwardness impelled out-migration.

1941-51

Apart from the World War II which had broken out a year before the close of the last decade, the most spectacular event of the decade 1941-51 was the independence of the subcontinent and the creation of Pakistan, in 1947. Despite the World War and communal riots preceding Independence, economic progress had continued in the region at a brisk rate. Famines having long since been brought under control, and the effects of epidemics having been arrested, the period 1941-51 was generally favourable for population growth. However, Independence, otherwise a blessing, made all the difference.

At Independence, the Punjab was partitioned between India and Pakistan, according to the Radcliffe Award. Thus, Pakistani Punjab got - without Bahawalpur division - an area of 163,136 sq. km. and a population of about 16 million, of which roughly 25 per cent were non-Muslims. Indian Punjab, on the other hand, got an area of 96,938 sq. km. and a population of about 12.5 million, of which 35 per cent were Muslims. (56)

The Partition unleashed a storm of violence followed by large scale loss of life and massive movement across the borders, involving millions. The violence that was designed at total elimination of Muslims in the Indian Punjab, resulted in over one million deaths.

> "The Sikhs are clearing East Punjab of Muslims, butchering hundreds daily, forcing thousands to flee westward, burning

> Muslim villages and homesteads.... This violence has been organized from the highest levels of Sikh leadership, and it is being done systematically, sector by sector." (57)

In the words of Davis (1951):-

> "Accompanying the Partition, beginning before and lasting for months afterwards, was a wave of religious rioting, murder, and arson, together with mass migrations across the newly established borders... Sporadic riots and forced migrations were still occurring in 1950... There arose spontaneously one of the largest and quickest mass migrations in human history. No one knows and no one will ever know the exact figures, but it appears that about 6 million Muslims came into Pakistan and about 5 to 6 million left it. Something like one million of the total died in the process from starvation, exhaustion, disease or murder." (58)

Communal discord and strife not only pushed the death rate upwards, but also uprooted and displaced millions. As a result, large scale redistribution of population took place, with a far-reaching impact on the region's population growth. Migration flow was so rapid that, within four months of Independence (up to 10 December 1947), the Punjab alone had received 4.7 million refugees whose number swelled further in the following months. It is estimated that the Punjab's net in-migration during this period was in the region of 1.7 million.(59)

Due to a significant difference between the influx of muhajirs (refugees) and loss of non-Muslims, as well as to natural increase, the Punjab's population rose by over 20 per cent during the period 1941-51 (Table 3.5). At the district level, Lyallpur (54.2 per cent), Multan (42.0) and Sahiwal (36.6) experienced the highest increase rates followed closely by the three districts of the Bahawalpur division (Fig. 3.7 (b)). As the in-migrants were mostly farmers and quite aware of the high productivity and prosperity of canal irrigated districts, their first choice was to settle in these districts. According to the 1951 census, 26 per cent of Punjab's population consisted of muhajirs, and at the district level, Lyallpur had the highest share - 45.8 per cent of its population consisted of muhajirs, followed by Lahore (39.3), Sahiwal (39.3) and Multan (30.7). (60) Absolute numbers of the in-migrants and their excess over out-migrants played an important role in the regional variation of population increase.

3.2.3. The Post-Independence Period

It can be summed up from the previous discussion that the Punjab's population almost doubled between 1901 and 1951, at an average annual growth rate of 1.4 per cent. The highest increases at the district level were shown by the districts which experienced high levels of in-migration as a result of canal irrigation as well as due to influx of muhajirs at the time of Independence. We now turn to an examination of the region's post-1951 population change.

1951-61

The first census of independent Pakistan in 1951 placed the country's total population at 33,499,462 which rose to 42,905,571 in 1961, an increase of 28.1 per cent at an average annual rate of 2.5 per cent. The Punjab's population increased from 20,651,140 to 25,487,529 during this period, by 23.4 per cent or at an annual rate of over 2.1 per cent. As can be seen from Figure 3.5, Pakistan's rate of growth during the period 1951-61 was the highest in its history whereas the Punjab's was the second highest - a little less than that experienced between 1931 and 1941.

In terms of percentage change, the Punjab's population increase between 1951 and 1961 was the lowest amongst Pakistan's provinces except Baluchistan. However, with a much larger population base, it alone added 4,836,389 and thus contributed 51.4 per cent of the country's numerical change (Table 3.9). This strikingly high rate of population increase in Pakistan and its provinces which could be much higher if underenumeration in the 1961 census is taken into account, was mainly due to a high natural increase, resulting from a sharp decline in the mortality rate owing to the improvement in the health facilities as well as in the environmental conditions (Section 3.5). It was as if Pakistan in 1951 embarked upon a "take-off" stage in its population growth. In the Punjab all districts experienced high rates of population increase.

Figure 3.8 (a) shows the percentage change and Figure 3.8 (b) the numerical change in the Punjab's population by districts between 1951 and 1961.

TABLE 3.9

POPULATION GROWTH IN PAKISTAN BY PROVINCES, 1951-72

Province/Region	1951		1961				1972			
	Population	% of Pak.	Population	% of Pak.	Change No.	%	Population	% of Pak.	Change No.	%
Punjab	20,651,140	61.6	25,487,529	59.4	4,836,389	23.4	37,610,159	57.6	12,122,630	47.6
Sind	6,135,050	18.3	8,367,065	19.5	2,232,015	36.4	14,155,909	21.7	5,788,844	69.2
NWF	4,111,460	12.3	5,730,991	13.4	1,619,531	39.4	8,388,551	12.8	2,657,560	46.4
Baluchistan	1,186,637	3.5	1,353,484	3.1	166,847	14.1	2,428,678	3.7	1,075,194	79.4
FCTI	83,170	0.3	119,307	0.3	36,137	43.5	234,813	0.4	115,506	96.8
FATA	1,332,005	4.0	1,847,195	4.3	515,190	38.7	2,491,230	3.8	644,035	34.9
PAKISTAN	33,499,462	100.0	42,905,571	100.0	9,406,109	28.1	65,309,340	100.0	22,403,769	52.2

SOURCE: Computed from : District Census Reports 1972 (52 Vols.)

As will be seen, Rahimyar Khan (52.8 per cent) outweighed all districts in terms of percentage change. It was followed by Bahawalpur (39.3), Mianwali (35.7) and Muzaffargarh (31.8). Together these four districts experienced a numerical change of 1,123,514 or 45 per cent in their 1951 population. In terms of numerical change, on the other hand, Multan district outclassed all the others by adding 594,751. It was followed by Lahore (584,459), Lyallpur (530,975) and Sargodha (304,633). Together these four districts showed an increase of 2,014,818 or 27.5 per cent in their 1951 population.

Whereas in the old canal colony districts such as Multan, Lyallpur and Sargodha, economic conditions further improved due to a horizontal and vertical development of agriculture and also because of the newly introduced but fast developing manufacturing activity; in Mianwali and Muzaffargarh, the high rate of population growth was due to in-migration associated with the canal irrigation from the Jinnah and Taunsa Projects. Out of the numerous reclamation schemes initiated or completed during the period 1951-61, the Jinnah and Taunsa both on the Indus, were of great significance. The Thal development scheme had, in fact, been initiated in 1947, soon after Independence, for the recovery of vast stretches of desolate waste between the Indus and the Jhelum. The Jinnah Barrage, completed in 1958, provided irrigation water to the desert wasteland of Mianwali, Sargodha and Muzaffargarh districts which, with the passage of time, was converted into valuable agricultural land. Numerous villages came into existence and a number of new planned towns such as Jauharabad, Quaidabad, and Liaqatabad were established and settled by in-migrants.

The second most important irrigation scheme - the Taunsa Barrage - was constructed on the Indus near Taunsa (district Dera Ghazi Khan) which provided water for crops in Muzaffargarh and Dera Ghazi Khan districts. As a result, some 567,000 ha. of land was brought under the plough in these two districts. (61) Dera Ghazi Khan's unprecedented population growth rate (23.1 per cent) is thus associated with the in-migration due to the changed food base as a result of the

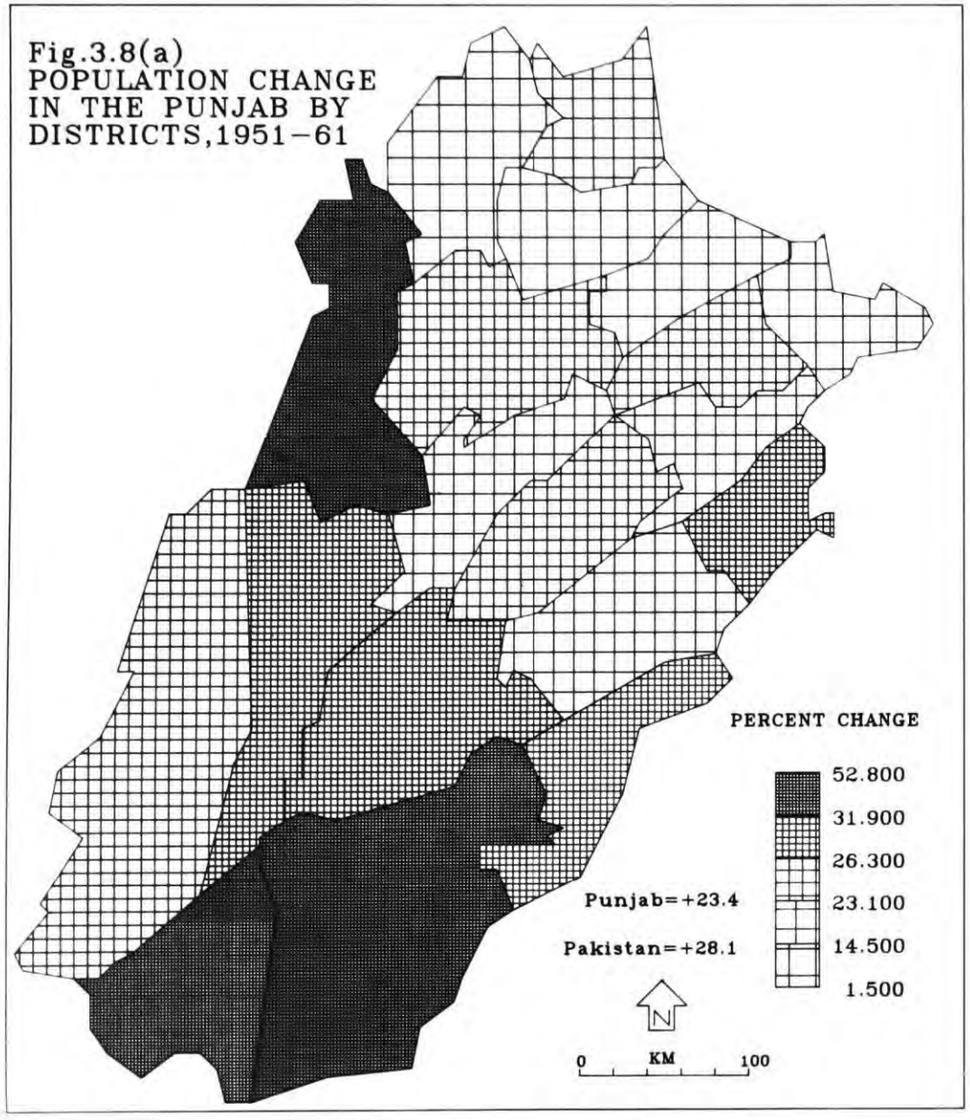


Fig.3.8(a)
POPULATION CHANGE
IN THE PUNJAB BY
DISTRICTS,1951–61
PERCENT CHANGE
52.800
31.900
26.300
23.100
14.500
1.500
Punjab=+23.4
Pakistan=+28.1
N
0 KM 100

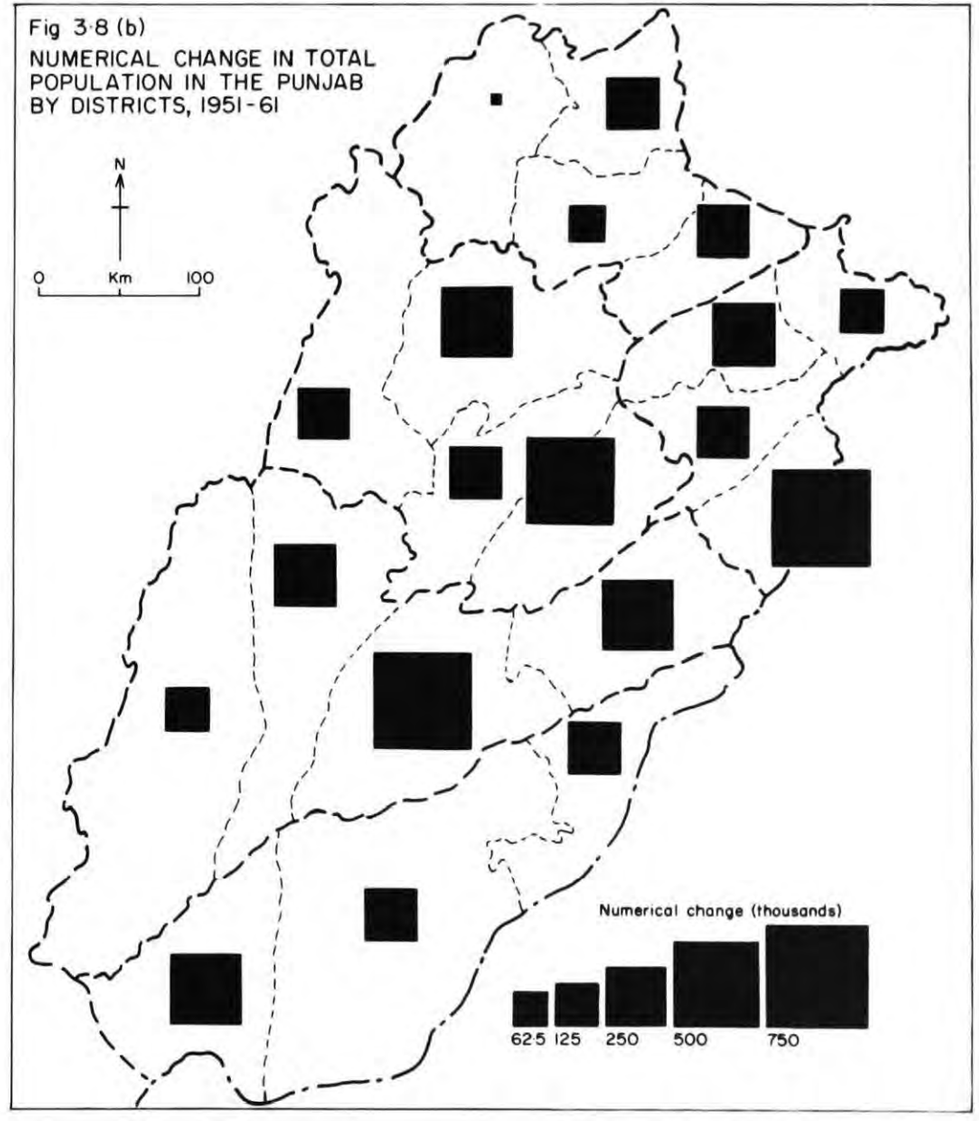


Fig 3·8 (b)
NUMERICAL CHANGE IN TOTAL
POPULATION IN THE PUNJAB
BY DISTRICTS, 1951-61
N
0 Km 100
Numerical change (thousands)
62·5 125 250 500 750

enlarged irrigation facilities. The same factors were applicable to Rahimyar Khan and Bahawalpur districts where additional water supplies from the Panjnad and Sulemanki headworks played a significant role in the horizontal development of agriculture and thus broadening the food base. In addition, Rahimyar Khan, like the other old colony towns, became the centre of numerous industries, mainly agro-based.

Lahore's high level of population increase between 1951 and 1961 was linked, in addition to its agricultural, industrial and commercial development, with its upgrading as the capital of West Pakistan on the merger of the four provinces into "One Unit". Thus it became the focus of all government and public activities and its "magnetic field" extended throughout the present Pakistan. The ensuing in-migration, together with a high natural increase, not only increased the urban population of the metropolis but had also a considerable bearing on the population change of the Lahore district.

Somewhat similar factors operated in the case of Rawalpindi which, due to the change of Pakistan's national capital from Karachi to Islamabad in 1959, became the focus of in-migration. This, to a great extent, inflated the population size of Rawalpindi city as well as the district. But the real repurcussions of this in-migration took shape in the succeeding decade, which will be discussed in the next section. The lowest population increase rates between 1951 and 1961 were shown by Campbellpur (1.5 per cent), Sialkot (8.3) and Jhelum (9.8). These three districts also experienced the minimum numerical changes and together increased their population by only 199,328 (7 per cent), mainly due to out-migration.

It can be summed up that Pakistan and the Punjab experienced an unprecedented high rate of population growth during the period 1951-61, mainly due to a sharp decline in mortality connected with the improvement of the economic and social climate. The differential rates of population change in the Punjab's districts were, however, mainly associated with internal migration.

The districts with improved economic situation became the recipients of a high level of in-migration which had a great bearing on the pattern of their population change; while the districts with less congenial economic atmosphere, suffered from out-migration and thus experienced lower levels of population change.

1961-72

Pakistan's population rose by 52.2 per cent from 42,905,571 to 65,309,340 between 1961 and 1972, the highest rate of increase in Pakistan's population history. Thus, whereas during the first sixty years of the twentieth century, the country's population experienced a numerical change of about 26.3 million, during the next 11 years and 8 months, 22.4 million were added (Table 3.9). The implied growth rate of 3.67 per cent per year - almost 1½ times that of the preceding decade - stunned almost all population investigators, not only because it shook their confidence in the country's population control programme but also because, coupled with a massive population base, it tends to make Pakistan one of the fastest growing countries in the world.

This unprecedented high growth may be associated with a continuously accelerating natural increase due mainly to the decline in mortality. It may also be an outcome of the inaccuracies of the 1961 and 1972 census data. Before the 1961 census, Pakistan's annual rate of population growth was generally considered to be under 2 per cent. This was partly due to the inadequacy of data, particularly the birth and death statistics, but also due to the Planning Commission's deliberate efforts to show it lower, in order to "keep despair away". (62) The 1961 census results, however, gave an average annual growth rate of over 2.5 per cent. Numerous investigations into the authenticity of census results, based on the analysis of age and sex distribution, further revealed that there was a substantial underenumeration of population to the extent of 6.2 to 8.4 per cent. Krotki (1963) estimated an undercount of 3.95 million or 8.4 per cent in the 1961 census, while the Planning Commission's (1964) estimate of underenumeration was 3.22 million or 7 per cent. The US Bureau of

the Census (1965) gave an estimate of the underenumeration in the vicinity of 3.72 million or 7.5 per cent, while Bean et al's (1968) estimate was 2.88 million or 6.2 per cent. (63) Thus, although the magnitude of the estimated underenumeration differed, there was a general accord amongst most experts about an undercount of population in the 1961 census. Thus, whereas some population scientists were flabbergasted by the massive population size revealed by the 1972 census, there were others who had, in fact, predicted such a magnitude of Pakistan's population. As a result, the 1972 census figures earned two types of reaction. According to one opinion, there was an overenumeration in the 1972 census, while in the views of other investigators, the population was, as in 1961, undercounted.

Considering the Pakistan Government's commitment to a strong population policy and the resultant effectiveness of family planning programmes, the failure of development plans to meet health targets and to achieve planned reduction in mortality, a fair degree of government-induced emigration, mainly to the Middle East for employment; and only a negligible net immigration due to repatriation from East Pakistan (Bangladesh), Bean (1974) suggested an overenumeration of population in the 1972 census. (64) Whereas he supported his hypothesis with the vital rates yielded by the Population Growth Estimation Survey (1962-65), he also pointed out a tendency of overreporting in Pakistan's smaller provinces. Afzal (1973) argued that there was an underenumeration of population in the 1972 census. (65) To support his argument, he has drawn upon three of the numerous projections of Pakistan's population which are fairly close to the census totals. Considering the relative accuracy of the 1961 and 1972 census enumerations, the level of natural increase during their intervening period, and the impact of age distribution, Afzal came to the conclusion, through a collation between the projected populations of these sources and the then available provisional census totals, that the underenumeration in the 1972 census was to the tune of 2.47 to 3.6 per cent. The differences calculated by him but corrected vis-a-vis the

TABLE 3.10

1972 PROJECTED AND CENSUS POPULATION OF PAKISTAN

Source	Assumption	1972 Projected Population (000) Interpolated to September			Difference (000) of Projected and (1972 Census Population)		
		Male	Female	Total	Male (34,833)	Female (30,476)	Total (65,309)
US Bureau of the Census (1965)	A CF, CM	33,832	32,699	66,531	-10001	+2,223	+1,222
	B DF, CM	32,259	31,189	63,448	-2,574	+ 713	-1,861
	C CF, DM	34,251	33,065	67,316	- 582	+2,589	+2,007
	D DF, DM	32,629	31,511	64,140	-2,204	+1,035	-1,169
Bean,L.L.,Khan,M.R. and Rukanuddin,A.R. (1968)	I CF, DM	35,350	31,232	66,582	+ 517	+ 756	+1,273
	II CF upto 1970 and then DF,DM	34,160	31,832	65,992	- 673	+1,356	+ 683
	III DF, DM	33,018	30,693	63,711	-1,815	+ 217	-1,598
Planning Commission	I CF CM	32,030	30,799	62,829	-2,803	+ 323	-2,480
	II DF DM	32,198	30,961	63,159	-2,635	+ 485	-2,150

C : Constant D : Declining F : Fertility M : Mortality

SOURCES : 1. Afzal (1973)

2. Pakistan Statistical Yearbook 1977

final census totals are presented in Table 3.10,which reveal a slightly lower degree of underenumeration - 1.84 to 2.98 per cent.

Another study about the authenticity of the 1972 census results was conducted by Krotki (1976). In his critique of the 1972 Census Evaluation Survey (CES), he concluded, through a study of age distribution as well as fertility and mortality levels, that Pakistan's population could be 67 million at the time of the 1972 census. (66) This means, there was an undercount of almost 2 million or 3 per cent in that census. In a subsequent study, Krotki and Parveen (1976) made a greater use of the age and sex distribution for their analysis and reasserted the earlier view about underenumeration. (67)

Whatever the quantum of over or under enumeration in the 1972 census, it is certain, that Pakistan experienced a substantial population increase between 1961 and 1972. Improvement in the areal completeness and overenumeration in the provinces of Sind, the NWF and Baluchistan contributed to this increase but rather insignificantly,compared with the overall change. The accelerated growth of population, in fact, reflects the high level of natural increase occasioned by the widening gap between fertility and mortality rates because of a substantial decline in mortality and a near-constant level of fertility. The Crude Birth Rate (CBR) which had stayed at 50 per thousand between 1951 and 1961, had gradually fallen to 45 by 1973-74. The Crude Death Rate (CDR), on the other hand, registered a steeper decline from 30 per thousand in 1947 to 20 in 1965 and about 15 at the end of the period 1961-72. This could, in a way, be interpreted as the beginning of "demographic transition" and reflects Pakistan's steady economic progress during the period in question.

The period 1961-72 sustained the strains of two major wars with India (1965 and 1971),but did also witness, at least in its first eight years, an internal political stability - a rare commodity in Pakistan's chequered career, which, in turn, prompted economic progress. Although economic planning in Pakistan had been launched earlier, it acquired a serious tone with the initiation of the

Second Five Year Plan (1960-65) followed by the Third (1965-70). As a result, the country made great strides in its economy, so much so that the rate of economic growth far exceeded that of population growth. Between 1960-61 and 1965-66, for example, Pakistan's GNP grew by 7.3 per cent per annum compared with population's 2.9 per cent. During the Third Five Year Plan period (1965-70), these rates were 5.2 and 2.9 per cent respectively. The overall change during the period 1961-72 was 5.9 per cent per year in the GNP and 2.9 in population. (68)

Table 3.11 shows the change in Pakistan's economy in terms of a large number of selected indicators. As is clear, during the period 1961-72, the GNP almost doubled to over 35,000 million Rupees. The per capita income which had demonstrated a slow growth rate of 7 per cent during the previous decade, now grew six times as rapidly. Due to a substantial improvement in the physical factors of agricultural production such as water, improved seed, fertilizers, plant protection materials and modern implements, the agricultural sector demonstrated a great recovery from its near-stagnant position in the 1950's. Consequently, the index of agricultural production went up by 88 per cent in all crops and by 84.7 per cent in food crops compared with 11.1 and -2.0 per cent respectively in the previous decade. But, although food grain production rose by 77.9 per cent compared with a modest increase of 15.8 per cent between 1951 and 1961, the country could not attain the level of self-sufficiency in food-stuffs. However, with the increased food imports, the per capita food availability, which had dropped by 2.5 per cent during the period 1950-1/1960-1, improved by 25.6 per cent.

Due to significant structural transformation, the non-agricultural sectors made increasing contribution to the country's economy, and thus imparted a degree of strength to that. The index of large scale manufacturing went up by 69 per cent between 1964-65 and 1972-73. In addition, all modes of energy supply experienced momentous rises (Table 3.11). As a result of substantial

TABLE 3.11 SELECTED INDICATORS OF PAKISTAN'S ECONOMIC DEVELOPMENT 1950-1/1972-3

Item	Unit	1950-51	1960-61		1972-73	
		Quantum	Quantum	% Change	Quantum	% Change
National Income*[1]						
Gross National Product	million Rupees	12,863	17,624	37.0	35,153	99.5
Contribution of Agriculture	million Rupees	6,768	7,695	13.7	12,821	66.6
Contribution of Manufacturing	million Rupees	1,042	2,278	118.6	5,514	142.1
Per Capita Income	Rupees	356	381	7.0	539	41.5
Index of Agricultural Production*[2]						
All crops		90	100	11.1	188	88.0
Food crops		100	98	-2.0	181	84.7
Fibre crops		86	103	19.8	243	135.9
Per Capita Availability of Foodgrains	kgs per day	0.40	0.39	-2.5	0.49	25.6
Index of Large Scale Manufacturing		-	100*[3]	-	169	69.0
Energy Supply						
Oil	thousand tonnes	1,030	1,751	70.0	3,995	128.2
Coal	thousand tonnes	513	915	78.4	1,143	24.9
Gas	mill.cu.m	-	708	-	3,764	431.6
Hydroelectricity	million MJ	212	2,322	995.3	15,606	572.1
Road Length	km	26,268	32,793	24.8	35,750	9.0
Movement by Rail (Passenger km)	million	6,246	9,197	47.2	11,069	20.4
Number of Educational Institutions						
Primary Schools		9,411	20,909	122.2	49,580	137.1
Middle and High schools		2,603	2,970	14.1	6,904	132.5
Arts and Science Colleges		46	131	184.8	334	154.9
Enrolment in Educational Institutions						
Primary Schools	thousands	920	2,060	123.9	4,460	116.5
Middle and High schools	thousands	320	610	90.6	1,430	134.4
Arts and Science Colleges	thousands	21	71	238.1	186	162.0
Expenditure on Education	million Rupees	42.9	121.6	183.5	501.4*[4]	312.4
Expenditure on Health Services	million Rupees	11.6	44.9	287.1	108.7*[4]	142.1

(-) Not available

*[1] At constant factor cost of 1959-60. *[2] 1959-60 = 100 *[3] For 1964-65. *[4] For 1971-72.

SOURCES:
1. Pakistan Economic Survey 1977-78
2. Pakistan Economic Survey 1973-74
3. 25 Years of Pakistan in Statistics

acceleration in the country's income, expenditure on development registered a sharp increase: expenditure on education rose by 312.4 per cent and on health services by 142.1 per cent, during the period under review.

To sum up, the period 1961-72 was not only free from any major deterrent factor but had, on the contrary, a propitious climate for a rapid population growth. The period witnessed numerous public health programmes and anti-disease drives which caused a considerable decline in deaths from such diseases as malaria, typhoid, smallpox and tuberculosis. The establishment of maternity and child welfare centres depressed infant mortality rates and, in turn, enhanced a child's chances of survival at birth. Due to a significant increase in the numbers of doctors and para-medical staff, modern hospital equipment, improvement in the existing health facilities and their extension to the rural areas, general health standards showed a marked improvement.

Thus an interplay of socioeconomic and medico-environmental causes, rising income levels and broadening health facilities created a climate in which mortality dropped sharply. However, fertility did not decline correspondingly and the extensive family planning campaign could only succeed in preventing the birth rates from rising further. Consequently, the gap between births and deaths broadened - the net result was an unprecedented increase in the country's population size and its growth rate.

The inaccuracy and the impelled adjustment in the 1961 and 1972 census populations notwithstanding, in the present investigation census data were accepted prima facie. This was necessitated by two reasons. First, as stated in Section 1.2, the present study is region-oriented. In order to have an insight into the spatial variation of phenomena and to go deep down to a "micro" level in their analysis, there is need to have population and other relevant data for the areal units that constitute our area of study. Whereas numerous studies have pointed out the deficiencies of census populations and have suggested adjustments at the national level, they have been conspicuous in not providing any such adjustment at the tehsil, district or divisional level. This short-

coming can be remedied if we prepare our own adjusted data for these levels. However, there is no accurate way of doing this. Recourse, therefore, has been made to the 1972 District Census Reports which have provided most of the required data for the three post-Independence Censuses. Second, the major adjustment in the census population that has met an almost universal accord, is concerning the 1961 census; the 1972 figures have still not been sufficiently carefully revised. This suggests that the overall change for the period 1951-72, which is the principal concern of our investigation, remains almost unaffected.

As Table 3.9 indicates, the Punjab's population rose from 25,487,529 in 1961 to 37,610,159 in 1972 - an increase of 12,122,630 or 47.6 per cent or an average growth rate of 3.4 per cent per year. Not only did the Province experience a slower growth rate than Pakistan's southern provinces,Sind and Baluchistan, but its share in the country's population also declined from 59.4 to 57.6 per cent during this period. The decline in the Punjab's share of Pakistan's population can, in fact, be attributed to more rapid urbanization in Sind and Baluchistan which drew migrants from all over Pakistan. While the Punjab's urban population during this period grew by 68.2 per cent and Pakistan's by 72.2 per cent, in Sind and Baluchistan it rose by 80.8 and 74.9 per cent respectively. The Punjab's share of the country's urban population accordingly dropped from 56.7 to 55.3 per cent and Sind's rose from 32.9 to 34.5 (Table 3.22). There is also evidence of a small degree of interprovincial rural-rural migration due to the opening up of additional land for cultivation in Sind and Baluchistan whereby the Punjab lost some of its rural population to these provinces, particularly from its high man/land ratio areas. (69) In rural population, the Punjab experienced an increase of 41.9 per cent during the 1961-72 period; and Sind and Baluchistan 62.1 and 80.4 per cent respectively, compared with the country's 46.3 per cent. During the same period the Punjab's share of the country's rural population declined from 60.2 to 58.3 per cent while Sind's mounted from 15.6 to 17.3 and Baluchistan's 3.4 to 4.2 per cent (Table 3.22).

The Punjab's reduced share of the country's population and slower growth rate vis-a-vis other provinces might also be explained in terms of its lower fertility level connected with its relatively faster economic growth and its earlier entry into "demographic transition". But, in the absence of statistical evidence, particularly about the provincial fertility levels, such a hypothesis cannot be put forward with certainty. Similarly there is no ground to suggest that birth rates in Sind and Baluchistan remained higher and death rates lower. However, as discussed in Section 1.6, it is likely that the conspicuously abnormal rates of population growth in Sind and Baluchistan were partly because of better coverage in enumeration and partly because of overreporting and overenumeration associated with political factors.

As stated earlier, the Punjab's rate of population increase between 1961 and 1972 was 47.6 per cent, more than double that of the previous period. Every district, in turn, experienced a sharp growth rate, higher than in the previous intercensal period, with the exception of Rahimyar Khan, where the rate of growth slowed dramatically; and Bahawalnagar, where it remained the same. In six districts the rate of population change was higher than the Provinces and in ten more than twice as much as in the previous period (Table 3.6).

Figures 3.9 (a) and 3.9 (b) show respectively the percentage and the numerical change in the Punjab's population by districts, between 1961 and 1972. As can be seen, most districts located in the fertile Rechna and Bari <u>doabs</u> continued to experience rapid population increases. In terms of percentage change, Gujranwala (59.4) ranked first, followed by Muzaffargarh (58.1), Lyallpur (58.0) and Rawalpindi (57.5). Together these four districts experienced a change of 3,539,065 or 58.3 per cent. The slowest rates were witnessed by Bahawalnagar (30.5), Sahiwal (32.9), Rahimyar Khan (37.7) and Campbellpur (40.2). Together these four distcits showed a change of 1,618,448 or 34.6 per cent. In terms of numerical change, Lyallpur, Multan and Lahore each added over a million and together experienced a change of 4.2 million, nearly 2½ times that of the last period, and thus contributed over one third of the Province's numerical change

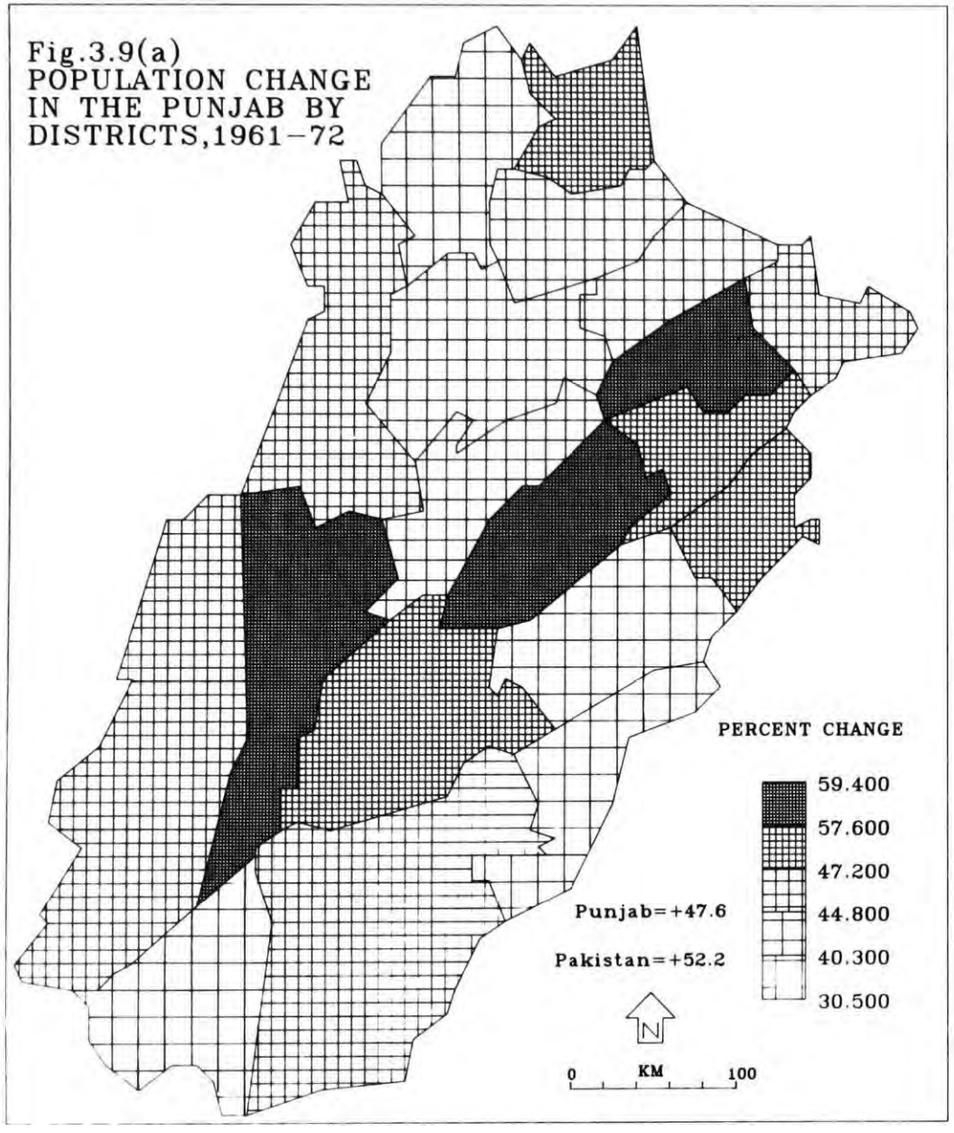


Fig.3.9(a)
POPULATION CHANGE
IN THE PUNJAB BY
DISTRICTS,1961–72
PERCENT CHANGE
59.400
57.600
47.200
44.800
40.300
30.500
Punjab=+47.6
Pakistan=+52.2
N
0 KM 100

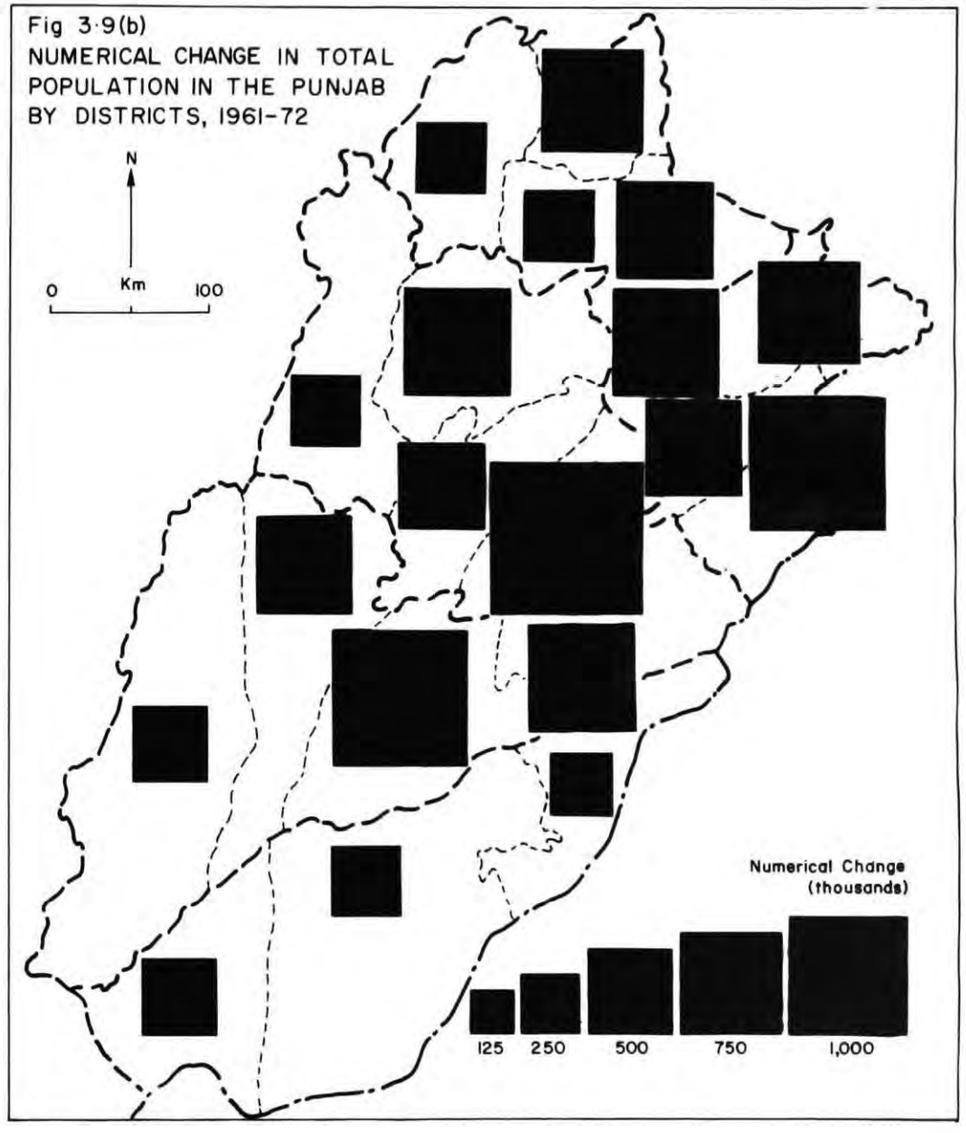


Fig 3·9(b)
NUMERICAL CHANGE IN TOTAL
POPULATION IN THE PUNJAB
BY DISTRICTS, 1961-72
N
0 Km 100
Numerical Change
(thousands)
125 250 500 750 1,000

between 1961 and 1972.

In addition to the high natural increase which has already been discussed, agricultural prospects continued to provide incentives for population growth. Besides, accelerated industrialization and rapid urbanization played a vital role in the population redistribution and ultimately in the regional differences of population growth.

The region's agriculture which had, in fact, stagnated during a greater part of the period 1951-61, staged a dramatic recovery through the reclamation of the waterlogged and saline tracts in the Chaj and Rechna doabs and a rapid expansion of irrigation effected by the increased and much more regulated surface water supplies because of the completion of numerous Indus Basin Projects, as well as due to the exploitation of ground water via tube well technology. The increased water supply together with a fair degree of mechanization and greater use of chemical fertilizer resuscitated the decaying agriculture and laid down the basis for the "Green Revolution". As a result, the old canal irrigated areas intensified their agriculture while in a number of other districts such as Jhang, Sialkot, Muzaffargarh and Dera Ghazi Khan, it experienced horizontal growth.

Agricultural growth combined with a brisk industrial expansion and a rapidly accelerating commercial activity provided the necessary impetus for urbanization. Gujranwala's rapid rate of population increase (more than 2½ times than in the previous period), for example, can be attributed to a combination of all these factors. The district experienced a rapid growth of urban population (79.9 per cent) during the 1961-72 period in which the influx of 36,598 army personnel to the newly opened cantonment also played a significant part. Lyallpur's unabated high population increase - numerical as well as percentage - was also linked with its agricultural development, speedy industrialization and increased commercial activity. Good road and rail networks served as a catalyst for these economic activities and resulted in their forceful interaction. Sheikhupura, because of its situation in the Punjab's "industrial triangle" and

in close proximity of Lahore, witnessed a rapid industrial development. Its agricultural production recovered due to the rehabilitation of waterlogged and saline areas and then picked up with the increased irrigation water. Its location on the routes connecting the two principal industrial - commercial - urban centres : Lahore and Lyallpur, as well as the extension and improvement in its road network, boosted the commercial activity in various market towns which, in turn, contributed to the district's high population growth rate which was more than three times that of the previous period.

Similar factors operated in the case of Rawalpindi which, being the twin rather the "doorway" of the new national capital Islamabad, experienced a rapid increase in the district population - 57.5 per cent compared to 22.1 per cent during the 1951-61 period. Due to the transfer of the capital next door, Rawalpindi's district urban population rose by 89.8 per cent between 1961 and 1972 - more than twice that experienced in the previous decade. The associated commercial activity and a good degree of industrialization were the phenomena closely linked with the high increase in the district population. Muzaffargarh's rapid population increase can be attributed to its phenomenal agricultural development linked with the increased irrigation water. Many farmers from other parts of the Province, particularly from the central districts, in search of better prospects or to expand their land holdings, moved in to buy agricultural land at cheaper rates and in greater quantities than in their districts of origin.

Rahimyar Khan's surprisingly reduced rate of population change (37.7 as against 52.8 per cent of the 1951-61 period) may be attributed to out-migration. Although the district kept its important position in industrial and commercial activities, in the rural sector it could not keep pace and many of its farmers who had earlier migrated in to reclaim its barren land, now passed on, with their experience of desert reclamation, to the adjoining Sind, where the cheaper newly opened lands offered better prospects. They were joined by many others from the Province's other districts.

To sum up the post-Independence population change, the Province experienced an increase of 16,959,019 or 82.1 per cent during 21 years and 8 months between 1951 and 1972,at an average rate of 2.8 per cent per year. The post-Independence period is thus markedly significant in population growth in terms of both numerical change and the rate of growth. During these 21.67 years, the numerical increase (16,959,019) outweighed that during the preceding 50 years (10,337,050). Accordingly, the compound growth rate was exceptionally high - 2.8 per cent compared with 1.4 during the first half of the twentieth century. If the 1951-72 increase of 16,959,019 is equally spread throughout the Province, each square kilometre of its territory will receive an additional 82 persons, against the corresponding figure of 40 for the whole Pakistan. At the district level, the highest rates of population growth during this period were shown by Rahimyar Khan (110.5 per cent), Muzaffargarh (108.3), Bahawalpur (102.9), Lahore (99.1) and Mianwali (99.0) (Fig. 3.10(a)). In terms of numerical change, five districts passed the million mark : Lyallpur (2.1 million), Multan (1.90), Lahore (1.89), Sahiwal (1.02) and Gujranwala (1.01) which together experienced an increase of 87.6 per cent.

We can now summarize Punjab's population evolution in the twentieth century. Between 1901 and 1972, the Province's population grew by 264.7 per cent, from 10.3 million to 37.6 million. The implied average compound rate of such a vigorous increase was over 1.8 per cent per year. During the same period Pakistan's total population increased by 294 per cent, from 16.6 million to 65.3 million, at an average annual rate of 1.9 per cent. The Punjab's share of the nation's population was 62.2 per cent in 1901 and 61.7 in 1951 but declined to 57.6 at the 1972 census (Table 3.5). The fastest evolution of population within the Province took place in the old canal colony districts.Lyallpur, Multan and Sahiwal experienced the highest level of population increase in terms of both numerical and percentage change. Lahore ranked eighth in the growth rate but third in the numerical change, while the trans-Sutlej districts and Sargodha

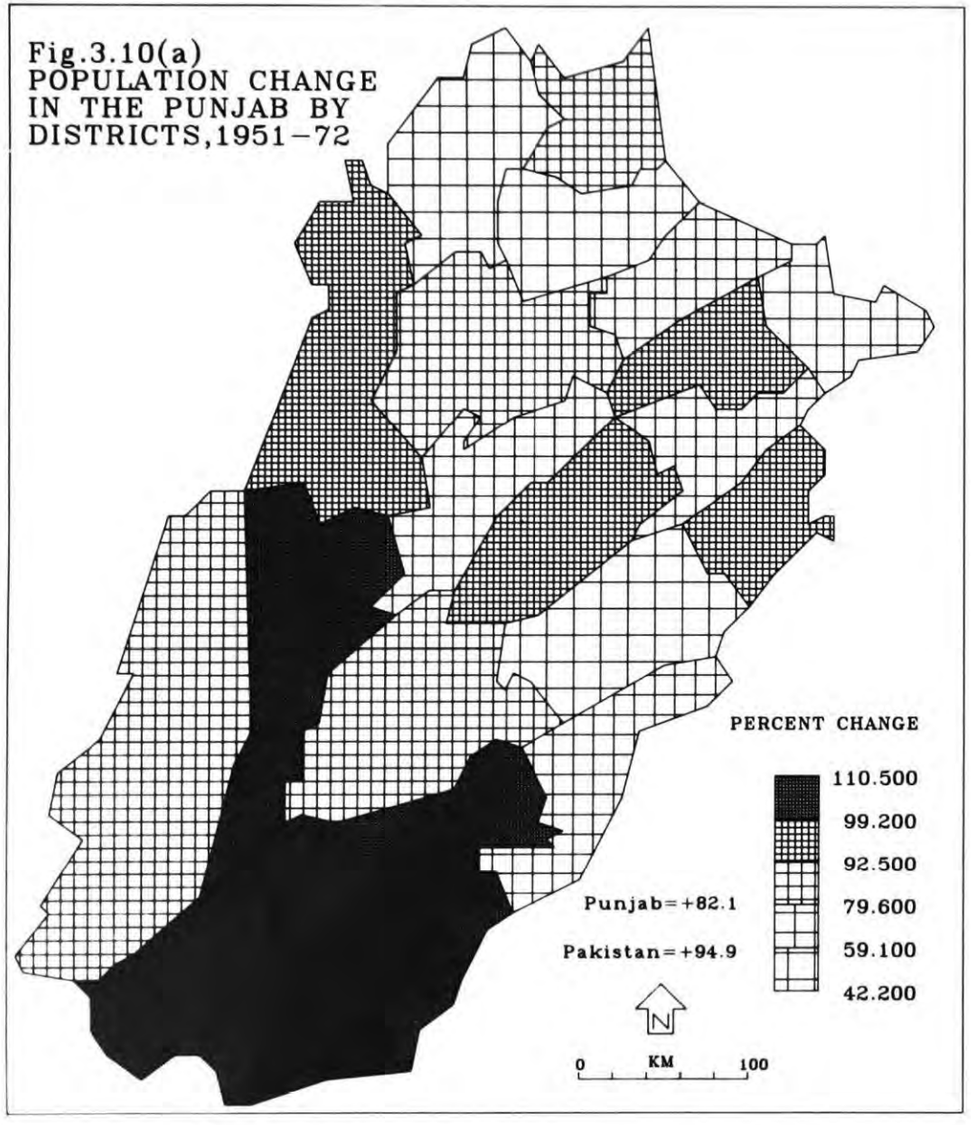


Fig.3.10(a)
POPULATION CHANGE
IN THE PUNJAB BY
DISTRICTS,1951–72
PERCENT CHANGE
110.500
99.200
92.500
79.600
59.100
42.200
Punjab=+82.1
Pakistan=+94.9
N
0 KM 100

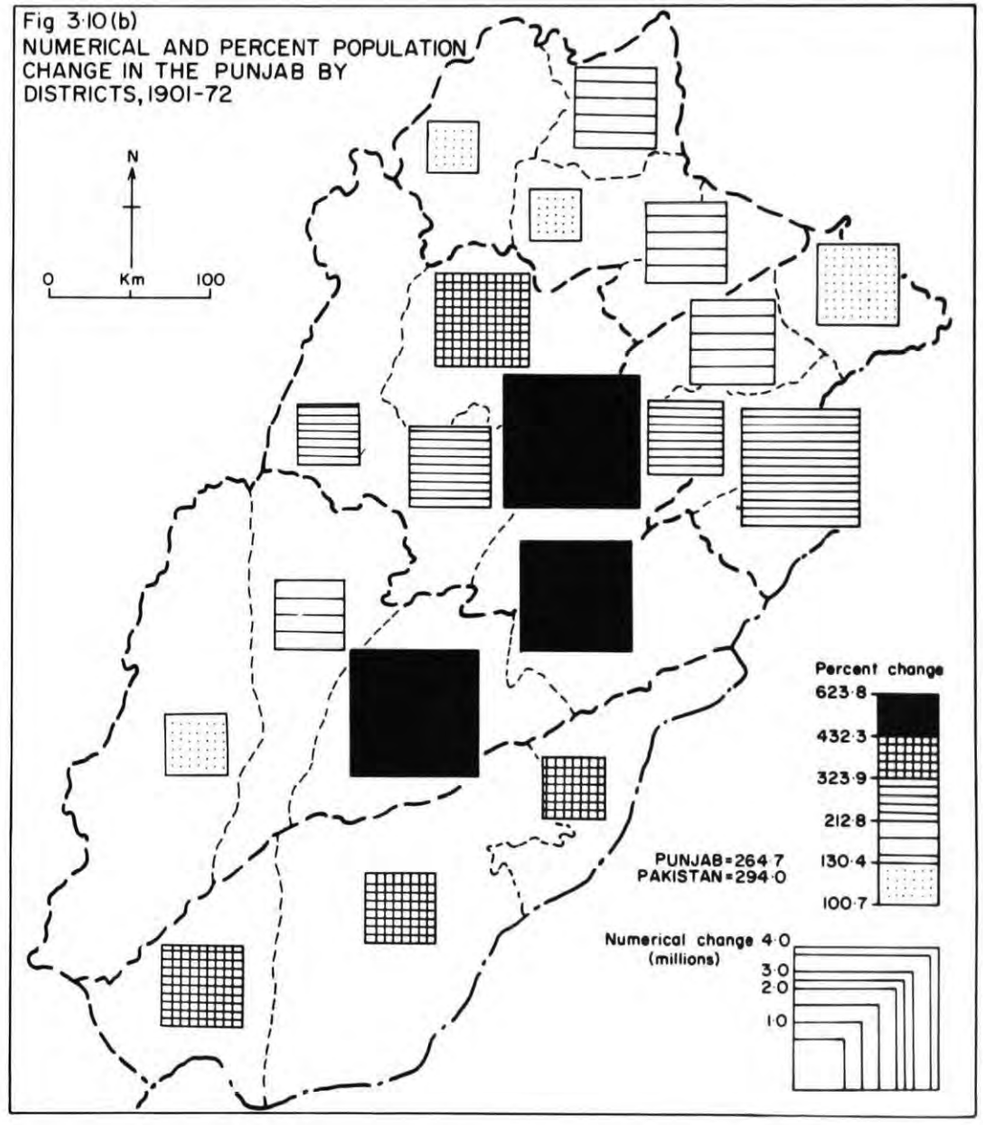


Fig 3·10(b)
NUMERICAL AND PERCENT POPULATION
CHANGE IN THE PUNJAB BY
DISTRICTS, 1901-72
N
0 Km 100
Percent change
623·8
432·3
323·9
212·8
130·4
100·7
PUNJAB=264·7
PAKISTAN=294·0
Numerical change 4·0
(millions)
3·0
2·0
1·0

experienced rates between 330 and 435 per cent. The eight districts, each with over 300 per cent increase, together experienced a change of 16,689,714 or 437.5 per cent and the remaining eleven districts increased their population by 10,606,355 or 163.2 per cent (Fig. 3.10 (b)).

3.3. CURRENT POPULATION

As stated earlier, the Punjab had a census population of 37.6 million at the end of September 1972. Pakistan's average annual population growth rate which was 3.7 per cent between 1961 and 1972 on the basis of census populations is, in official circles, taken to have been 3.0 per cent [70] mainly because of adjustment to the 1961 census figures. Applying this rate to the Punjab's 1972 population, it will have almost 48 million people at the end of 1980.

Another route to arrive at the Punjab's current population size is through the country's estimates. As stated in Section 3.1, in 1979, Pakistan's population was estimated to be 84 million. This will have increased, on the basis of 3.0 per cent annual rate, to 87.8 million by the end of 1980. Assuming that the Punjab's share of the national population stayed where it was in 1972, its population size comes out as 50.6 million. However, the interprovincial disparities of economic growth in view, it is likely that the Punjab's share in Pakistan's population will have dropped further. If the rate of decline in the Province's share were equal to that between 1961 and 1972, it could contain, in 1980, almost 56.4 per cent of Pakistan's population or 49.5 million. Thus, in population size, the Punjab is comparable to Turkey (44.6 million), the Philippines (47.7), Thailand (46.7), Vietnam (52.1) and Egypt (41.0). [71]

3.4. FUTURE POPULATION

Pakistan has been the subject of numerous population projections. One of these forecasts the country's population until the end of the twentieth century under three different assumptions.[72] According to this projection, Pakistan's population will be over 194 million by the year 2000 if birth rates

TABLE 3.12 POPULATION PROJECTIONS OF PAKISTAN, 1975-2000

(Mid-year Population in thousands)

Year	Bean et al			Planning Division Technical Sub-Committee
	Assumption I	Assumption II	Assumption III	
1975	73,228	71,821	68,251	69,805
1980	88,291	83,429	76,977	80,137
1985	107,342	96,070	85,284	91,453
1990	130,670	111,544	95,198	103,436
1995	159,252	129,949	106,383	-
2000	194,600	151,292	118,497	-

Assumption I : constant fertility, declining mortality.

Assumption II : constant fertility until 1970, then 30 per cent linear decline up to 1980-85, constant thereafter; declining mortality

Assumption III : declining fertility, declining mortality.

SOURCES : 1. Bean et al (1968)

2. Population Projections for Pakistan

do not decline; but will be about 151 million if the stipulated reduction in fertility takes place (Table 3.12).

Another projection was prepared by the Technical Subcommittee appointed by the Inter-departmental Working Group on Population Growth, on the basis of the 1961 census population as adjusted for seven per cent underenumeration. (73) In order to work out the level of population growth, birth and death rates yielded by the Population Growth Estimation (PGE) Project for the period 1962-65 were used. The assumptions involved were that, from 1960-65 to 1985-90, CDR would fall from 19 to 12 per thousand, whereas the CBR would be constant until 1970, at the level of 1960-65, but decline thereafter linearly by about 26 per cent up to 1985. The country's future population forecast by these projections is given in Table 3.12 alongside those of Bean et al. A comparison between the two projections reveals that the Technical Subcommittee's estimates fall between those given by the assumption I and assumption II of Bean et al, and are likely to be more plausible, since the population of September 1972 interpolated from them is very close to the 1972 census total. However, like any population projection, their validity depends upon the country's actual fertility and mortality levels in future, the completeness and the resultant accuracy of birth and death statistics, government's population policy and the people's response to that as well as a multitude of other factors.

Once again, the Punjab's future population can be estimated on the basis of its ratio to the country's population. Assuming, for example, that the Punjab's share of the national population varied between 56.0 and 57.6 per cent, and Pakistan's population at the end of the twentieth century is about 151 million; the Punjab's population size will be between 85 and 87 million in the year 2000. On the basis of the 1961-72 intercensal growth rate, on the other hand, the Province's population can be extrapolated as 96.7 million at the close of the twentieth century.

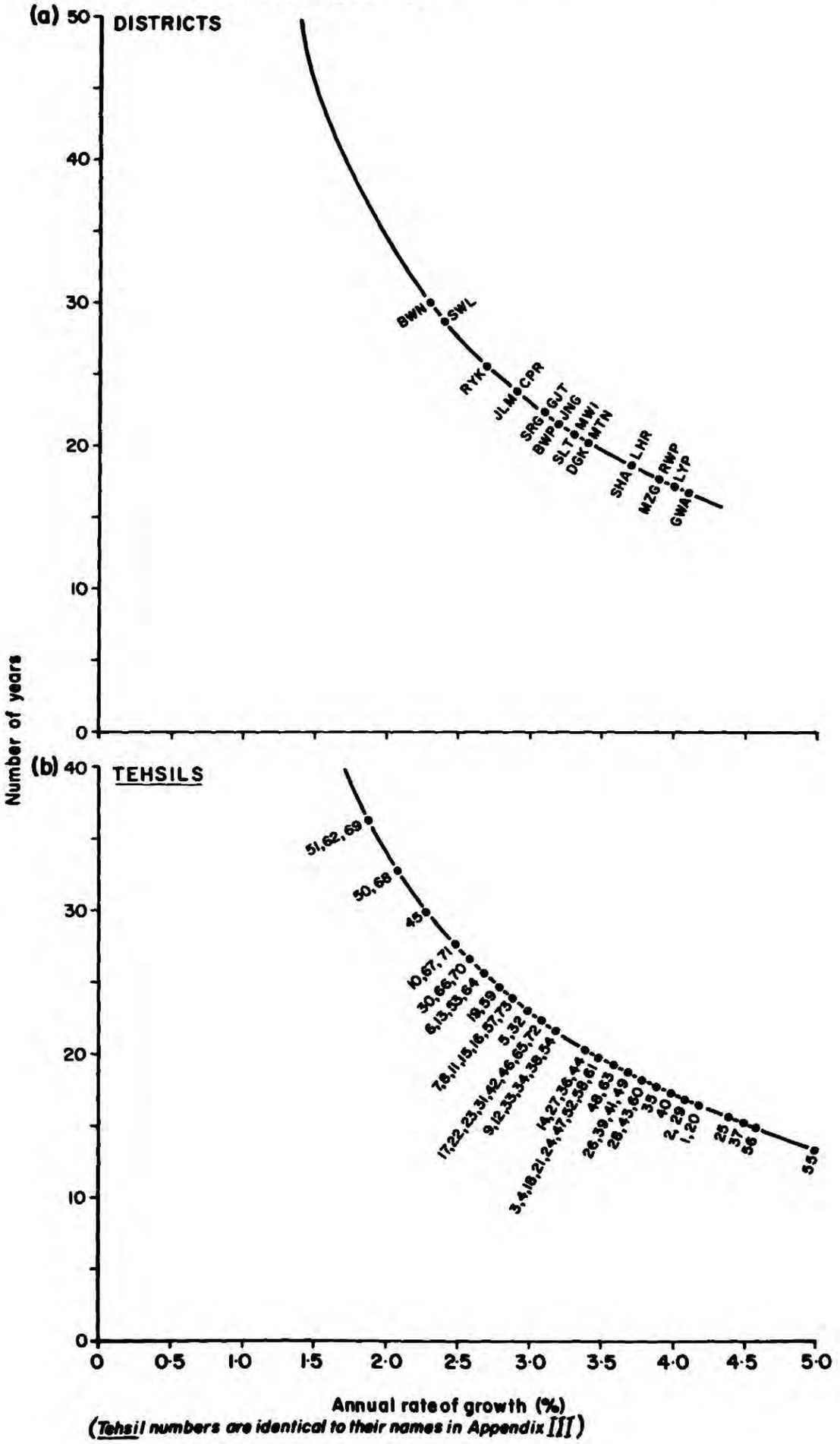
Figures 3.11(a) and 3.11(b) indicate the number of years required by the

TABLE 3.13 EXTRAPOLATED POPULATION OF DISTRICTS ON THE BASIS OF 1961-72 GROWTH RATES

Districts	Population (30.9.1972)	Rate of Growth 1961-72 %	Extrapolated Population 1.1.1981	1.1.1991	1.1.2001
BWN	1,073,891	2.3	1,295,490	1,626,262	2,041,488
SWL	2,836,889	2.4	344,998	437,337	554,391
RYK	1,398,879	2.7	1,742,755	2,274,787	2,969,239
CPR/JLM	2,033,598	2.9	2,574,494	3,426,460	4,560,363
GJT/SRG	4,000,133	3.1	5,145,865	6,983,048	9,476,145
JNG/BWP	2,632,032	3.2	3,413,097	4,676,765	6,408,295
MWI/SLT	3,439,557	3.3	4,496,040	6,220,616	8,606,699
MTN/DGK	5,149,904	3.4	6,785,683	9,479,795	13,243,547
LHR/SHA	5,431,156	3.7	7,329,377	10,540,340	15,158,010
RWP	1,747,685	3.9	2,396,301	3,513,151	5,150,534
LYP/MZG	5,806,680	4.0	8,025,146	11,879,176	17,584,082
GWA	2,059,755	4.1	2,869,354	4,288,362	6,409,125
TOTAL	37,610,159		46,418,600	65,346,099	92,161,918
PUNJAB	37,610,159	3.4	49,556,382	69,231,697	96,718,681

SOURCE: Computed by the author

Fig. 3-11
NUMBER OF YEARS REQUIRED FOR POPULATIONS TO DOUBLE AT 1961-72 RATES



(Tehsil numbers are identical to their names in Appendix III)

TABLE 3.14 EXTRAPOLATED POPULATION OF TEHSILS ON THE BASIS OF 1961-72 GROWTH RATES

Tehsil Numbers*[1]	Population (30.9.1972)	Rate of growth 1961-72 %	Extrapolated Population 1.1.1981	1.1.1991	1.1.2001
51,62,69	1,012,576	1.9	1,182,673	1,427,600	1,723,250
50,68	1,199,104	2.1	1,423,375	1,752,172	2,156,921
45	402,783	2.3	485,898	609,960	765,698
10,67,71	816,896	2.5	1,001,472	1,281,969	1,641,029
30,66,70	1,333,231	2.6	1,647,673	2,129,828	2,753,076
6,13,53,64	1,681,067	2.7	2,094,311	2,733,667	3,568,207
19,59	603,222	2.8	757,566	998,508	1,316,081
7,8,11,15,16,57,73	2,718,644	2.9	3,441,749	4,580,712	6,096,586
5,32	991,188	3.0	1,264,920	1,699,947	2,284,587
17,22,23,31,42,46,65,72	3,866,479	3.1	4,973,930	6,749,729	9,159,526
9,12,33,34,38,54	2,599,010	3.2	3,370,276	4,618,090	6,327,896
14,27,36,44	2,323,150	3.4	3,061,059	3,245,508	4,534,068
3,4,18,21,24,47,52,58,61	3,722,486	3.5	4,944,142	6,974,201	9,837,800
48,63	837,431	3.6	1,121,158	1,596,851	2,274,374
26,39,41,49	2,137,729	3.7	2,884,878	4,148,729	5,966,266
28,43,60	2,394,253	3.8	3,256,853	4,729,026	6,866,655
35	448,623	3.9	615,120	901,811	1,322,120
40	840,954	4.0	1,162,244	1,720,405	2,546,620
2,29	2,775,270	4.1	3,866,106	5,778,047	8,635,517
1,20	1,147,013	4.2	1,610,560	2,430,268	3,667,173
25	1,705,118	4.4	2,432,392	3,741,438	5,754,976
37	1,245,258	4.5	1,790,477	2,780,556	4,318,118
56	313,137	4.6	453,807	711,521	1,115,590
55	495,537	5.2	752,846	1,249,866	2,075,013
TOTAL	37,610,159		49,595,485	68,590,409	96,707,147
PUNJAB	37,610,159	3.4	49,556,382	69,231,697	96,718,681

*[1] Tehsil numbers are identical to Appendix III

SOURCE: Computed by the author

Punjab's districts and tehsils respectively to double their populations at the 1961-72 intercensal growth rates. The post-1972 populations for various growth categories of districts and tehsils are tabulated and presented in Tables 3.13 and 3.14. A comparison between these two tables reveals that the Province's extrapolated populations for 1981, 1991 and 2001 are closer to the total of tehsils' extrapolations than those of the districts. However, as explained earlier, there is a good deal of scepticism about these growth rates on the grounds of the 1961 underenumeration. Such extrapolations, therefore, are to be taken with great caution.

3.5. COMPONENTS OF POPULATION GROWTH

As explained in Section 3.2, from 1921 onwards, the region's rate of population growth mounted sharply. This was due mainly to changes in the levels of fertility and mortality linked with the increased control over epidemics, drought and famine and reflected by a steady level of the region's socio-economic progress. The apparently smooth curve of the region's population growth (Fig. 3.3), in fact, conceals many vicissitudes of its components. In this section, we discuss the levels and performance of the ingredients of population growth viz. fertility, mortality and population movement.

3.5.1. The Data Problem

Although registration of births and deaths in the region dates back to the last quarter of the nineteenth century and is, therefore, a well established practice, the system has been extremely inadequate and a number of inquiries have revealed that the resultant data are grossly incomplete and inaccurate (Section 1.6). As a remedy, the Population Growth Estimation (PGE) Project was launched in 1961, aimed at collecting vital statistics through a sampling approach in selected areas. This yielded valuable estimates of the country's fertility and mortality levels for the period 1962-65. In 1968, the PGE Project was replaced by a basically similar, Population Growth Survey (PGS), which made

available data for the years 1968, 1969 and 1971.

Numerous inquiries have been conducted on the basis of the PGE and PGS data. Gustafson (1965) estimated CBRs and CDRs on the basis of the 1964 data of some PGE sample areas [74] and her results are set out in Table 3.15. The wide degree of areal variation in these rates depicts, more than anything, enormous variation in the quality of coverage as well as massive underregistration of vital events. While the LR (Longitudinal Registration) System of the PGE indicated a CBR and CDR of 41 and 15 per thousand respectively in 1964, Gustafson's inquiry for the same sample areas revealed that almost 50 per cent of the vital events were not recorded by the official registration. Seltzer (1968) suggested an underregistration of 43 and 50 per cent in births and deaths respectively, [75] while another study, through its investigation of the birth and death statistics of Pakistan's twelve biggest urban localities, found that the level of underregistration in these localities ranged between 20 and 90 per cent in the case of births and between 40 and 94 per cent in deaths. [76] For the rural areas, it was discovered that there was an underregistration, in 1968, of 57 and 60 per cent respectively in births and deaths. [77]

Another inquiry looked into the performance of the vital registration system in Rawalpindi city. Comparing its findings with the 1968 PGS rates, it discovered that, in 1967, there was an underregistration of 39 and 80 per cent in births and deaths. In 1972, the births were underregistered by 42 per cent while deaths by 77 per cent.[78] In the case of the Punjab, an underregistration of 40 and 73 per cent in births and deaths respectively was discovered during the period 1971-73. [79]

As we see, all these inquiries support the common conclusion that there is a substantial degree of underregistration of vital events in the country. In these circumstances, published birth and death rates for the region are to be taken with great caution.

TABLE 3.15 VITAL RATES FROM OFFICIAL REGISTRATION SYSTEM IN THE PGE SAMPLE AREAS, 1964

(Per Thousand)

Area		CBR	CDR
Aliwah (Punjab)		6	6
Bhedian Chak No.35 (Punjab)		15	3
Chak 82/GB (Punjab)		32	14
Hyderabad (Sind)	Urban	10	2
Karak (NWF)		45	10
Khudadad (Sind)		3	1
Leghari (Sind)		0	0
Mochh (Punjab)		27	3
Raman (Punjab)		4	1
Rawalpindi (Punjab)	Urban	21	2
Simbli (Punjab)		9	14
Wazirabad (Sind)		14	14
PAKISTAN		21	8

SOURCE: Gustafson (1965)

3.5.2. Crude Rates

Before 1947, elaborate information about the intercensal vicissitudes in the region's death and birth rates was published in its census reports. These sources reveal that, during the fifty years before 1921, when both death and birth rates were high, the average decennial birth rate in British Punjab remained generally in the region of 40-45 per thousand while the death rate, except in a few calamitous years, varied between 30 and 35. (80) But,as discussed earlier, the behaviour of these components underwent a tangible change after that date. The most dramatic change in the performance of death and birth rates, however, occurred after Independence, particularly in the 1960's.

According to the PGE's Cross-Sectional (CS) approach, the average CBR for Pakistan during the period 1962-65 was 38.7 per thousand and the average CDR, 12.0. The PGS average CBR and CDR, on the other hand, were 36.3 and 11.7 per thousand respectively, for the period 1968-71. (81) However, in Pakistan's official circles, the country's CBR is cited as 50 per thousand in 1961, 45 in 1972 and 43.6 in 1977-78. The corresponding CDRs for these years are 20, 15 and 13.8 per thousand. (82) A careful estimate of the average birth and death rates in the Punjab has been made by Burki (1973) for the period 1901-71 (83) which are set out in Table 3.16 and charted in Figure 3.12. As is obvious, the Province's CBR has remained virtually unchanged between 1901 and 1971, but the CDR has fallen considerably.

In order to obtain a more detailed picture of the performance of the components of population change, it is necessary to examine each component individually.

3.5.3. Fertility

Despite its obvious advantages, the crude birth rate has a limited utility as an index of fertility, since it is strongly influenced by the age and sex composition of the population to which it refers. Other measures of

TABLE 3.16 AVERAGE BIRTH, DEATH AND NATURAL GROWTH RATES IN THE PUNJAB, 1901-1970

(Per 1,000 Population)

Period	Birth Rate	Death Rate	Natural Growth Rate
1901-10	46.5	32.0	14.5
1911-20	46.5	38.0	8.5
1921-30	40.0	30.5	9.5
1931-40	44.0	24.0	20.0
1941-50	44.5	26.0	18.5
1951-60	47.5	20.0	27.5
1961-70	46.0	12.5	33.5

SOURCE: Burki (1973)

fertility, such as the age-specific fertility rate, which depicts variations of fertility with age, provide more meaningful information about the birth level of a society. Another useful index of fertility, the Total Fertility Rate (TFR), is a unitary measure of births per woman based on the current age-specific fertility.

Table 3.17 presents a picture of Pakistan's fertility level in terms of age-specific fertility rates and TFR between 1963-65 and 1974-75, obtained from a variety of sources. As is clear, the country had an overall TFR between 6 and 7 during this period. Among the various age groups, fertility was highest for those aged 25-29 with the rates declining on either side of that group. Another direct and perhaps more meaningful index of fertility is Gross Reproduction Rate (GRR), giving the average number of females to be born to a woman at the current fertility level. Still more refined indices of fertility are the Marital Total Fertility Rate (MTFR) and the Marital Gross Reproduction Rate (MGRR), which take into consideration married women only. Based on the PGE 1963-65 CS average and the PGS 1968 and 1971 average, the TFR, MTFR, GRR and MGRR for Pakistan were calculated [84] which are presented in Table 3.18.

An accurate comparison between the results given by different methods of data collection is difficult to make because of the variation in technique and the size of sample. The PGE and PGS rates, for instance, are subject to sampling and non-sampling variability of different magnitudes. The actual variation in the fertility behaviour with regard to time, therefore, may not come to the surface from a simple comparison of the rates given by different methods. However, a general indication of the decline of fertility in Pakistan may be obtained by comparing, for example, the average PGE (1963-65) rates and the average Pakistan Fertility Survey (1974-75) rates. For the first four age groups : 15-19, 20-24, 25-29 and 30-34, the average fertility rates between 1963 and 1965 were 126.6, 302.1, 368.5 and 348.5 per thousand respectively. In 1974-75, the corresponding average rates for the same age groups were 116.5, 297.9, 351.8 and 295.7. It is

TABLE 3.17 TOTAL FERTILITY RATE AND AGE-SPECIFIC FERTILITY RATES OF PAKISTAN, 1963-1974/5

Year	Total fertility rate(per woman)	Age-specific fertility rate (per 1,000 women) 15-19	20-24	25-29	30-34	35-39	40-44	45-49
			PGE Experiment*[1]					
1963	7.816	135.3	310.7	369.9	320.2	243.9	131.4	51.9
1964	8.284	138.3	338.7	380.8	362.2	243.0	106.0	87.7
1965	7.508	106.1	257.0	354.8	363.0	258.2	112.8	49.8
1963-65	7.948	130.0	303.1	373.2	352.5	250.0	114.4	66.5
			PGE Experiment (LR)*[2]					
1963	6.211	116.1	239.0	307.2	259.7	183.9	98.5	37.7
1964	5.842	112.0	236.9	280.7	269.6	159.5	57.1	52.7
1965	5.838	89.3	187.8	273.0	292.8	204.2	85.5	35.1
1963-65	6.094	110.0	226.0	291.5	283.2	187.3	78.8	42.1
			National Impact Survey					
1967-69	5.870	75.4	254.0	316.6	282.0	162.9	78.8	4.3
			Population Growth Surveys*[3]					
1968a	5.678	61.0	220.0	264.0	243.0	179.0	104.0	60.0
1968b	5.748	64.0	222.0	270.0	244.0	180.0	104.0	61.0
1969a	5.748	50.0	213.0	257.0	236.0	194.0	121.0	69.0
1969b	6.062	54.0	238.0	269.0	245.0	200.0	126.0	72.0
1971a	6.295	56.0	226.0	258.0	261.0	220.0	145.0	85.0
1971b	6.425	61.0	240.0	263.0	267.0	218.0	144.0	84.0
			Pakistan Fertility Survey*[4]					
1974-75a	7.174	119.1	304.6	359.6	302.3	233.6	106.5	9.2
1974-75b	6.861	113.9	291.3	343.9	289.1	223.4	101.8	8.8
1974-75c	6.265	104.0	266.0	314.0	264.0	204.0	93.0	8.0

*[1] Total fertility rates for 1963, 1964 and 1965 exclude births occurring to women under 15 and over 49 years of age. For 1963-65, the fertility rate for 15-19 age group includes births occurring to women under 15 and the fertility for 45-49 age group includes births to women over 49.

*[2] See note 1 above.

*[3] a : based on de facto data. b : based on de jure data
The TFR s for 1968, 1969 and 1971 take into account reported rates of 5.0, 9.0 and 8.0 respectively for women over 49 years of age.

*[4] Rates for 1974-75 a and 1974-75b are adjusted by the US Bureau of the Census. While the rates for 1974-75c are unadjusted and are based on data on births during the 12 months preceding the 1975-76 Pakistan Fertility Survey.

SOURCE: A Compilation of Age-Specific Fertility Rates for Developing Countries.

clear, therefore, that the country experienced a fall in its fertility level, though by a small amount. This is further corroborated by the declining MTFR and MGRR (Table 3.18).

Whatever the measure of fertility used, it is evident that the country has a high level of fertility and that change, even if experienced or in the offing, is very slow. While mortality in a society responds quickly to changes in the socioeconomic and medico-environmental spheres, fertility often shows its sensitivity to such changes only with a considerable lapse of time. High fertility is, in fact, endemic in a society like that of Pakistan with a strong proclivity towards perpetuating the traditional life style and family pattern, a high level of illiteracy, particularly among women, an overwhelming share of rural population and a general aversion to population control programmes and techniques.

The patterns of age at marriage have a considerable influence on fertility since they determine the effective length of the reproductive period. This relationship is particularly important in Pakistan where fertility is almost wholly confined to the married. The 1961 Family Law of Pakistan fixed the minimum age of marriage at 18 for males and 16 for females. However, numerous investigations to determine the average age at marriage in Pakistan have provided significant information in this respect. One of the earliest studies, based on the 1961 census age-sex distribution, revealed that the average age at marriage in Pakistan was 23.5 for males and 17.6 for females. Further, there existed, in these estimates, an urban-rural differential - the age being 24.1 for males and 18.3 for females in the urban localities and 23.4 and 17.4 respectively in the countryside. (85) In another study, Alam (1968) estimated, on the basis of the PGE age-sex data, that in 1964 the average age at marriage in the country was 24.7 for males and 19.1 for females. (86) According to Iftikhar and Afzal (1975) the respective ages were 25.2 and 19.3 years for the period 1962-65. (87) Another inquiry looked into the age at marriage of females amongst a sample of women in a suburban cluster of population near Lahore and revealed that the mean age at

TABLE 3.18 SOME FERTILITY VALUES OF PAKISTAN, BASED ON THE PGE 1963-65 CS AVERAGE AND THE PGS 1968 AND 1971 AVERAGE

(Per 1000 Females)

Index	Value	
	PGE (CS) 1963-65	PGS 1968 and 1971
Total Fertility Rate (TFR)	6.00	6.00
Marital Total Fertility Rate (MTFR)	7.47	7.34
Gross Reproduction Rate (GRR)	2.91	2.93
Marital Gross Reproduction Rate (MGRR)	3.64	3.58

SOURCE : Afzal (1974)

marriage was 18.9 during the period 1964-73, 17.8 during the period 1954-63 and 16.3 years before that. (88)

All these studies, in particular the last mentioned, support the conclusion that the mean age at marriage in Pakistan is progressively increasing, albeit at a slow rate. This may be attributed to a variety of factors including the improving socioeconomic climate, greater diffusion of education and an appreciable rise in general, but in particular female, literacy.

However, the hopes attached to the country's family (now population) planning programme have largely been dashed, since it has not apparently fulfilled the envisaged purpose. Started in 1953, Pakistan's family planning programme received increasing governmental attention and funds with the passage of time. Although in the First Plan (1955-60) the monetary allocation was not substantial (Rs.0.5 million) and, therefore, did not produce a tangible result; at the beginning of the Second Plan (1960-65), a more elaborate scheme with far greater funds (Rs. 30.5 million) was initiated. However, although a great improvement in the organization and expansion of the programme was witnessed, on the whole its impact fell much short of expectation. Consequently a greatly expanded government programme was launched in July 1965 and it received greater attention during the Third and Fourth Plans (1965-70 and 1970-75). Between 1966-67 and 1975-76, the number of conventional contraceptives sold rose from 62.7 million per annum to 148.9 million, the oral pill cycles from 44,856 to over 5 million and the number of yearly sterilizations from 1,824 to 14,743. (89)

The results of these programmes were, however, far short of the targets and, as we know, the country's CBR has not staged any substantial decline (Table 3.16). No doubt, in a country like Pakistan, with pronounced diversities of literate - illiterate, urban-rural and rich-poor, the population planning programmes are confronted with the formidable challenges which are intensified by religious orthodoxy and extremism.

The prevalent attitude in Pakistan's patriarchal, patrilocal and

overwhelmingly traditional society that sons are assets needed to contribute to the family's wealth and prestige and to support their parents in old age,results occasionally in the birth of a number of "unwanted" daughters. This line of thinking is unlikely to alter rapidly particularly in the rural areas where the sons are an important "force" as helpers in the fields and "protectors" of family honour and prestige. In addition, the dominant feature of the country's social life - the joint family system - is, according to some, supportive of high fertility and although there are visible signs of change with the growth of nuclear families, any concrete and far-reaching change is a long way off. (90)

The abysmally low level of female literacy (91), coupled with the institution of purdah or seclusion, makes it difficult for women to further their knowledge and understand the implications of and to take a positive attitude towards population planning. The generally weak motivation through the mass media, on the other hand, is fiercely challenged by the religious elements especially those with orthodox or extreme overtones.

Keeping in view the problems mentioned above, the population programme strategy for the Fifth Five Year Plan period (1978-83) has been revised so as to place greater emphasis on a more effective field programme embodying a sustained motivation and increased supply of contraceptives as well as on the improvement of living standards. This is envisaged to be achieved by coordinating and integrating population planning services with activities in other sectors such as Health, Education, Social Welfar, Housing, Agriculture, Mass Media, Manpower and Employment and by allocating more resources to the rural population. (92) However, the success of such an approach is difficult to predict.

3.5.4. Mortality

As in most other countries, the real "architect" of Pakistan's present large population size has not been its near constant level of fertility but its sharply descending mortality rate. The available fragmentary information reveals

that the country's CDR was in the region of 40 per thousand in the early part of the twentieth century but declined to about 30 by 1950. (93) After 1950, mortality fell at a faster rate, with a decline in the CDR from 30 in 1950 to 20 in 1961, 15 in 1972 and 13.8 per thousand in 1977-78. In the case of the Punjab, the average CDR during the first decade of the twentieth century was 32 but this had fallen to 12.5 by 1961-70 (Table 3.16). Thus declining mortality has made a significant contribution to the growth of the region's population.

As is clear from the above, the decline in the death rate was rather slow during the first half of the twentieth century but was rapid afterwards. In an attempt to explain the relative importance of factors responsible for the reduction in the death rate since 1901, Robinson (1967) divided the history of mortality decline in Pakistan roughly into four stages. (94) The first stage, extending over several early decades of the twentieth century, experienced the elimination of famines and epidemics which had almost regularly decimated the population every decade or so. During the second stage, the region's three traditionally most fatal diseases - plague, cholera and smallpox - were brought under control. By 1940, plague was eliminated completely and mortality from cholera and smallpox substantially reduced, largely through successful vaccination campaigns, organized public health efforts and improved environmental conditions. The third stage commenced in the 1950's following a temporary rise in mortality connected with Partition. This stage was characterized by a mortality reduction in absolute terms from all causes, except infant and maternal mortality and tuberculosis. The decline in mortality due to typhoid and malaria was most rapid. The causes of this decline were environmental-cum-medical, and mortality from all diseases declined because of an interrelated complex of socioeconomic and medico-environmental causes, a rise in the per capita income and nutritional level, improvement in sanitation and water supply particularly in the urban localities and greater availability of modern medicines, especially antibiotics.

The fourth stage which Robinson presumed to have already commenced, would see the final elimination of cholera and typhoid as well as of malaria due to the

malaria eradication programme;and tuberculosis as a result of BCG campaign, alongwith the rising nutritional and income levels, improvement in sanitation and water supply and reduction in fertility levels.

With the establishment of independent Pakistan, health and social welfare became a focus of government's attention. A reorganization of health services was initiated soon after Independence. By 1951, nearly 5 million people in towns had a protected water supply compared with 3 million in 1947. The number of medical colleges rose from one in 1947 to six in 1955 and the number of hospital beds increased from 15,000 to 23,000 during the same period. BCG vaccination against tuberculosis reached 14 million by 1955. (95) Considering malaria as one of the most serious health problems, attention was focussed on its control and eventual eradication, with an allocation of 23 million Rs. for the First Plan period (1955-60). Another 19.4 million Rs. were allocated for tuberculosis control.

A systematic anti-malaria campaign was started in parts of Pakistan in 1960-61, and was later extended to other parts of the country. Realizing that malaria alone was claiming 100,000 lives every year, 25 million Rs. were allocated during the Second Plan period (1960-55) towards its eradication through curative and preventive measures. (96) At the same time, an allocation of 4.5 million Rs. was made for the control of tuberculosis which claimed 150,000 lives every year. In the Third Five Year Plan (1965-70) the allocations for malaria eradication and tuberculosis control rose to 190 and 16 million Rs. respectively. (97) In addition, the overall health facilities were greatly improved with the increase of medical staff, hospital beds, maternity and child centres and extension of health services to the rural areas through the village development agencies.

In recent years, a considerable increase in expenditure on the health services has occurred. The total expenditure rose from 213.40 million Rs. in 1970-71 to 1242.94 million in 1977-8, from 0.47 per cent of the GNP to 1.0 per cent, increasing the per capita expenditure of health from 3.5 Rs. to 16.2. (98)

Although a substantial part of the increase in expenditure was absorbed by cost escalation, it nonetheless speaks of the government's interest and resolve to improve the country's health services. It has been envisaged that, during the Fifth Five Year Plan period (1978-83), due to extension of health facilities as well as improvement of sanitation and water supply, the CDR will be reduced from 14 per thousand to 10.2, and the infant mortality rate from 105 to 79. As a result, life expectancy is expected to rise from 54 to 60 for males and 53 to 59 years for females. (99)

It is obvious that these measures would further depress mortality in Pakistan which is, in turn, likely to raise the level of natural increase.

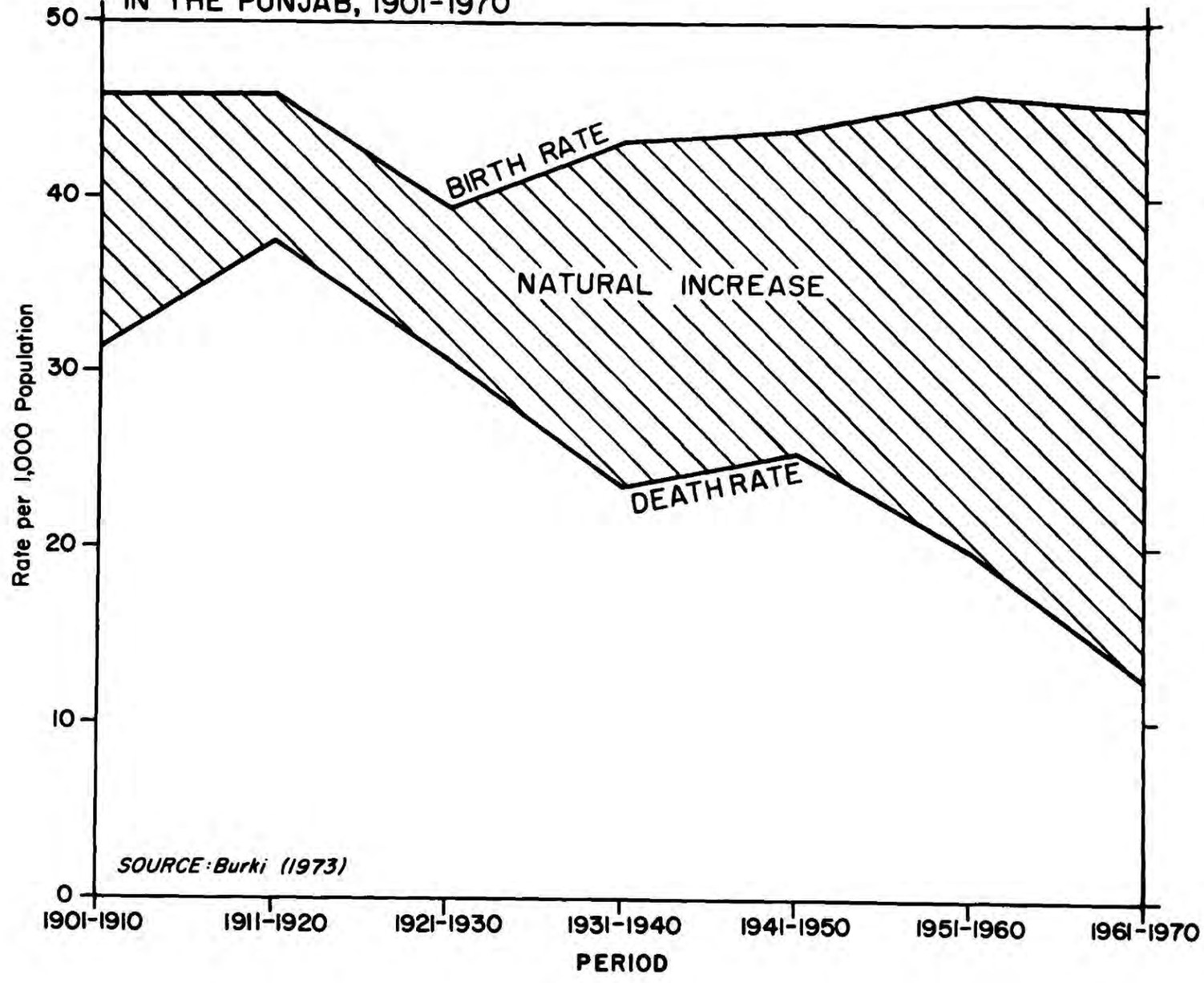
3.5.5. Natural Increase

Figure 3.12 presents a succinct picture of the interplay of fertility and mortality in the Punjab, for the period 1901-71. The gap between the two conveys the rate of natural increase and also the relative importance of the two components. As is clear, due to a substantial decline in mortality and a near-constant level of fertility, the Province's average natural increase rate mounted from 14.5 per thousand in 1901-11 to 33.5 during the 1961-70 period : a 2.3 times rise in almost three quarters of the century.

However, the natural increase rate has not climbed smoothly throughout this period and there are two conspicuous "bottlenecks" in the otherwise steadily widening gap between its components. During the period 1911-20, the influenza epidemic,with an estimated toll of one million lives, not only sharply raised the average death rate for that decade but also depressed the average birth rate in that as well as in the following decade. As a result, the average rates of natural increase remained at the lowest levels of 8.5 and 9.5 per thousand during the 1911-20 and 1921-30 periods respectively (Table 3.16).

Another rise in the average death rate was experienced during the period 1941-50 when approximately one million died at the time of Partition. As a

Fig. 3·12
AVERAGE BIRTH, DEATH AND NATURAL GROWTH RATES IN THE PUNJAB, 1901-1970



consequence, the average death rate rose from 24 per thousand in 1931-40 to 26 in 1941-50. The average birth rate rose from that in the previous decade, but by a very small margin, 44.0 to 44.5 per thousand. The net result was a decline in the average rate of natural increase. However, after Independence the difference between the birth and death rates has been continuously expanding and has thus raised the rate of natural increase.

3.5.6. Internal Migration

While natural increase in a region's population depends upon the relative behaviour of fertility and mortality, the overall population growth is determined by the additional component of migration.

It follows from our discussion in the preceding sections that Pakistan's overall population growth since the turn of the century, particularly after 1921, was due mainly to natural increase. However, the fact is that migration per se, though small by volume, has played a far from inconsiderable role in the regional contrasts of population growth and distribution particularly in the Punjab. The flow of population connected with the canal colonization and then at the time of Independence aside, internal migration, linked with agricultural expansion and mounting urbanization, continued to play its vital role in the regional disparities of population growth after Independence.

The volume and direction of internal migration in Pakistan has been measured on the basis of place of birth and age-sex data provided by the censuses. A recent study of internal migration in the country during various intercensal periods since 1901 was that undertaken by Khan (1972). [100] In order to calculate the average annual rates of net migration, the estimates of intercensal net migration in Pakistan's provinces given by this study have been compared with the provincial total population sizes at different censuses. The results are given in Table 3.19.

We have already discussed at length the volume and direction of migration as a consequence of canal colonization and Partition (Section 3.2). Between 1951

TABLE 3.19 AVERAGE ANNUAL RATE OF NET MIGRATION IN PAKISTAN'S PROVINCES, 1901-72

Province	Average Annual Rate of Net Migration (%)						
	1901-11	1911-21	1921-31	1931-41	1941-51	1951-61	1961-72
Punjab	+0.14	+0.21	+0.40	+0.42	+0.69	-0.12	-0.30
Sind	+0.42	+0.06	+0.66	+0.42	+0.82	+0.86	+1.40
NWF	+0.05	+0.10	-0.08	+0.36	-0.54	-0.27	-0.70
Baluchistan	+0.96	-1.4	-0.05	+0.51	+0.62	-0.54	+1.50

SOURCES: computed from 1. Afzal (1974)
2. Census of Pakistan 1951
3. Burki (1973)

and 1961, the Punjab, North West Frontier and Baluchistan lost 610,000 people who migrated to Pakistan's fourth province - Sind. Out-migration from these provinces averaged 0.2 per cent per year, and in-migration contributed 0.86 per cent annually to Sind's population. (101) The districts in the Punjab which lost considerably were Sialkot, Sahiwal, Jhelum and Campbellpur. Nonetheless, some districts in the Province such as Lyallpur, Lahore, Multan and Rahimyar Khan gained substantial numbers through net in-migration.

The volume of interprovincial migration mounted sharply during the period 1961-72, when the northern provinces - the Punjab and the North West Frontier - lost about 1.6 million people to the southern provinces: Sind and Baluchistan.(102) The annual rate of net migration in the four provinces was -0.3, -0.7, +1.4 and +1.5 per cent respectively (Table 3.19). These migration streams were, in part, responsible for the disparity in the intercensal population growth rates of the four provinces. While the Punjab and North West Frontier increased their populations by 47.6 and 46.4 per cent respectively, the increases in Sind and Baluchistan were 69.2 and 79.4 per cent respectively. As a result, the share of Sind and Baluchistan in the national population climbed between 1961 and 1972 from 19.5 to 21.7 per cent and 3.5 to 3.7 per cent respectively, while that of the Punjab and North West Frontier experienced a corresponding decline - 59.4 per cent to 57.6 and 13.4 to 12.8 (Table 3.9). The expansion of agricultural land via irrigation development in Sind and the adjoining parts of Baluchistan created a magnetic force to instigate rural-rural migration. This is clearly reflected in the changing shares of these provinces in the country's rural population (Table 3.22).

A clearer picture of the in-migrant population in the Punjab is provided by Figures 3.13 (a) and 3.13 (b) which depict respectively the total number of in-migrants and their percentage share in the total population of the Province's districts, according to the Housing Economic and Demographic (HED) Survey 1973. As is evident, the maximum number of in-migrants are found in the Lyallpur, Lahore

Fig 3·13(a)
NUMBER OF IN-MIGRANTS IN THE PUNJAB BY DISTRICTS, 1973

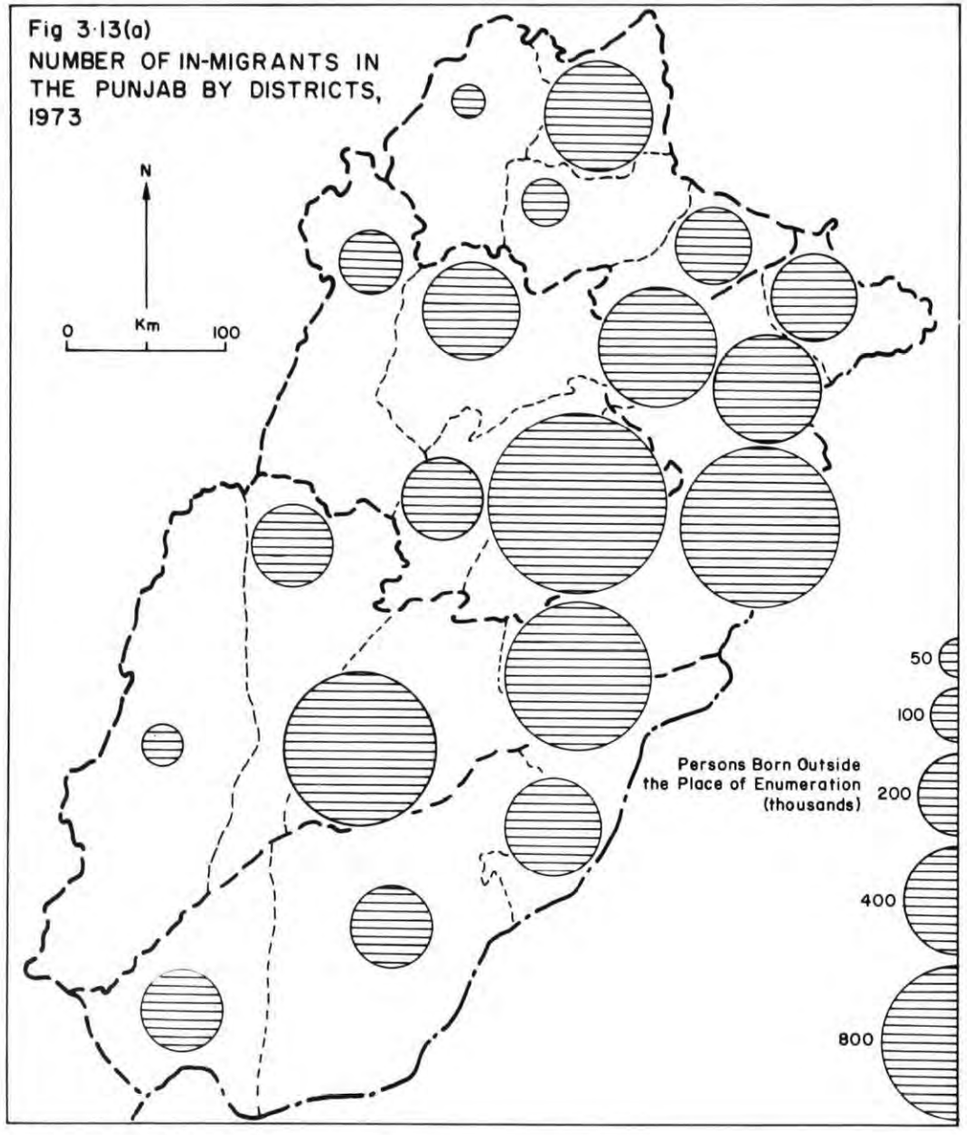
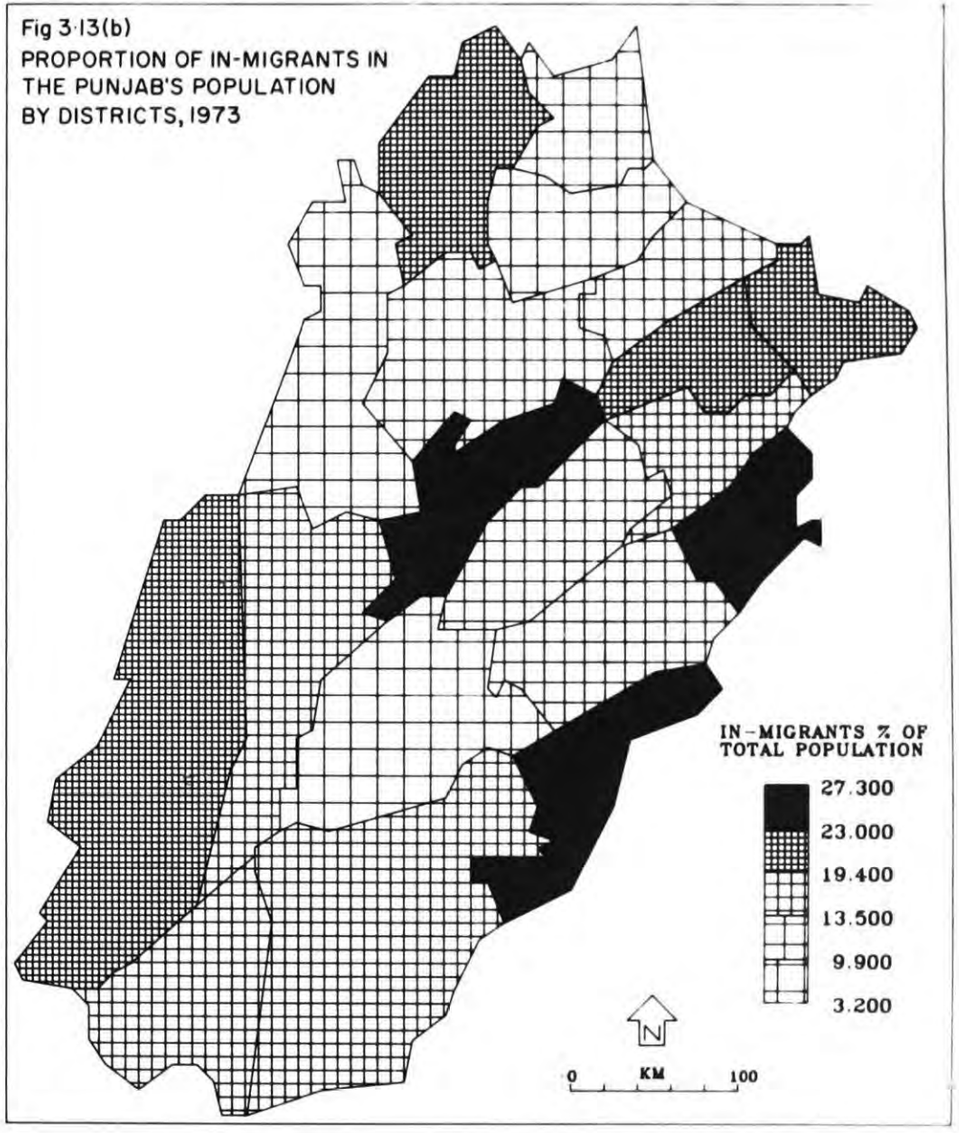


Fig 3·13(b)
PROPORTION OF IN-MIGRANTS IN THE PUNJAB'S POPULATION BY DISTRICTS, 1973



and Multan districts - 1,081,518, 956,916 and 807,797 respectively. In terms of the percentage share, however, Lyallpur (27.3 per cent) is followed by Bahawalnagar (26.4) and Lahore (25.9). In Lyallpur, Lahore and Multan, the streams of in-migration are explicable in terms of rising urbanization but in Bahawalnagar agricultural expansion is the main inducing agent. The lowest size of in-migration - number as well as rate - is found in the districts of Campbellpur, Jhelum and Dera Ghazi Khan, obviously associated with a low agricultural efficiency and a low level of urbanization.

It is evident that migration did not take place, as is conventional in most parts of the Third World, only from rural to urban areas; but due to a momentous agricultural expansion via irrigation development, rural areas also became the scene of massive inflow of migrants. An analysis of the 1972 data of the Punjab's 19 districts has revealed strong correlations between the net in-migration and : total population (r = +0.941), urban population (+0.781), rural population (+0.762) and arithmetic density (+0.756).

3.6. SPATIAL PATTERNS OF POPULATION GROWTH IN THE PUNJAB

In Section 3.2, the region's population growth was analyzed at length. Although the basic concern was to discuss population growth in the Punjab as a whole, we also analyzed in some detail the spatial patterning of the Province's population growth since 1901, at the "meso" level of districts. Since 1951, population data have also been available for the Punjab's 73 tehsils, adjusted to their present boundaries (Appendix III). Thus it is possible to conduct the analysis of the Province's population growth at the micro-regional level for the two post-Independence intercensal periods.

The tehsil level rates of total population growth, ordered into octiles, are mapped in Figures 3.14 and 3.15 for the 1951-61 and 1961-72 period respectively. The intercensal changes experienced in total and urban population by different "octile" groups have been summarized in Tables 3.20 and 3.21. As can

TABLE 3.20 POPULATION GROWTH IN THE PUNJAB BY TEHSILS, 1951-61 (OCTILE DISTRIBUTION)

Octiles	No.of Tehsils	Total Population 1951 No.	% of Punjab	1961 No.	% of Punjab	Change 1951-61 No.	%	Urban Population 1951 No.	% of total	1961 No.	% of total	Change 1951-61 No.	%
1 Highest	9	3,313,835	16.1	4,920,773	19.3	1,606,938	48.5	1,343,534	40.5	2,317,883	47.1	974,349	72.5
2	9	2,257,789	10.9	2,982,339	11.7	724,550	32.1	462,490	20.5	757,584	25.4	295,094	63.8
3	9	2,342,557	11.3	2,978,819	11.7	636,262	27.2	430,445	18.4	624,516	21.0	194,071	45.1
4	9	2,673,385	13.0	3,265,162	12.8	591,777	22.1	296,348	11.1	387,799	11.9	91,451	30.9
5	9	2,322,252	11.2	2,743,241	10.8	420,989	18.1	251,478	10.8	311,589	11.4	60,111	23.9
6	9	2,501,698	12.1	2,911,448	11.4	409,750	16.4	245,549	9.8	360,821	12.4	115,272	46.9
7	9	2,363,038	11.5	2,656,822	10.4	293,784	12.4	192,645	8.2	264,590	9.9	71,945	37.3
8 Lowest	10	2,876,586	13.9	3,028,925	11.9	152,339	5.3	364,441	12.7	435,751	14.4	71,310	19.6
PUNJAB	73	20,651,140	100.0	25,487,529	100.0	4,836,389	23.4	3,586,930	17.4	5,460,533	21.4	1,873,603	52.2

SOURCE: Computed from : District Census Reports 1972 (19 vols)

be seen, the rate of population growth has exhibited marked regional contrasts at the tehsil level. This regional differential of population growth is, in fact, the product of the regional variations in the rates of natural increase and the inter-regional movements including the rural-urban migration which are, in turn, influenced by a considerable variety of social, economic, political and other factors. The interaction between these factors is so intricate that it is exceedingly difficult to discern the precise role of any one or more and, therefore, any attempt to explain the patterns of change is somewhat subjective.

3.6.1. Spatial Variations in Population Growth, 1951-61

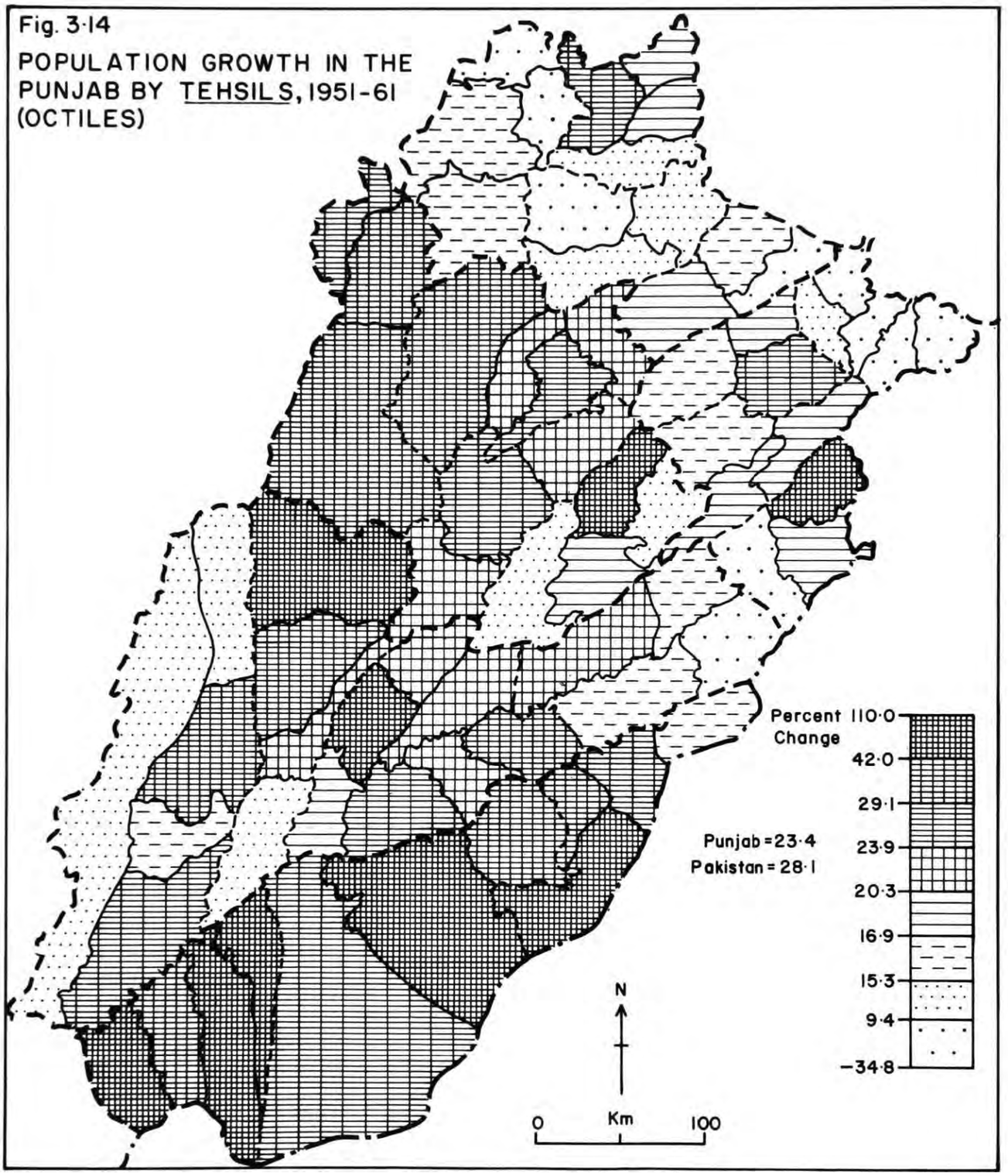
As indicated earlier, the Punjab's population increased by 23.4 per cent and that of Pakistan by 28.1 per cent, between 1951 and 1961. Of the Punjab's 73 tehsils, 29 registered growth rates well above the Provincial average. However, compared with the higher rate of Pakistan, only 20 of them scored a growth rate higher than the national average.

The highest rates of increase were shown by Khanpur (110 per cent), Leiah (68.4), Liaqatpur (57.6), Bahawalpur (54.4), Lyallpur (45.7), Sadiqabad (45.0), Fort Abbas (43.6), Lahore, (43.3) and Multan (42.3),which together experienced an increase of 1,606,938 or 48.5 per cent in their 1951 total population of 3,313,835 and increased their share of the Province's total population by 3.2 percentage points. Their urban population rose by 72.5 per cent to 2,317,883 during the same period, while their level of urbanization climbed from 40.5 per cent in 1951 to 47.1 in 1961 (Table 3.20).

Five of the nine most rapidly expanding tehsils between 1951 and 1961 lie in the trans-Sutlej districts of Rahimyar Khan and Bahawalpur. Their accelerated population growth may be attributed to in-migration associated with the better agricultural prospects on the land where reclamation had started in the recent past. In addition, a political factor seems to have played its part. With the integration of Bahawalpur into the "One Unit" of the then West Pakistan

Fig. 3·14

POPULATION GROWTH IN THE PUNJAB BY TEHSILS, 1951-61 (OCTILES)



in 1955, the erstwhile princely state became the new Bahawalpur division. This paved the way for a process of population "reshuffle", since the area became much more open to outside influences. With the in-movement of government offices and functionaries, the intending in-migrants, mostly cultivators, who were allured by the potentially prosperous land but had been hesitant to move in because of the feared low security in the state, also moved in. As a result, a tide of in-migration mainly from the Province's central, "push" areas set in. In addition, many muhajirs, who had earlier settled in other parts of the Province, decided to resettle in the Bahawalpur division. The period witnessed not only an increased degree of commercial activity linked with the better and improved communications, but also an accelerated level of urbanization and various urban localities experienced rapid increases in their populations : Rahimyar Khan (191.9 per cent), Fort Abbas (179.4), Sadiqabad (178.0), Haroonabad (125.4), Bahawalpur (102.6) and Khanpur (85.5). This, in turn, played a significant role in the population redistribution in the division. In fact, 1951-61 was the only period when 10 of the 11 tehsils in the trans-Sutlej Bahawalpur division experienced rates of population growth well above the Provincial average (Fig. 3.14).

Leiah's spectacular population increase (68.4 per cent) may be attributed to in-migration associated with the tehsil's rapid agricultural development. The increased availability of irrigation water from the Jinnah Project facilitated the horizontal expansion of agriculture;and subsidies, easy term loans and technical assistance, offered by the government as a part of the Thal development strategy, provided incentives for cultivators eager to expand their land holdings to move in, mainly from the old canal colonies. Moreover, the upheavals resulting from Partition had largely subsided by the beginning of the period in question, so many muhajirs who did not find life very promising in the areas where they had settled earlier, moved into the newly opened areas. This in-migration together with the improvement and expansion of roads supported high rates of growth in all tehsils of the Thal area.

TABLE 3.21

POPULATION GROWTH IN THE PUNJAB BY TEHSILS, 1961-72 (OCTILE DISTRIBUTION)

Octiles	No.of Tehsils	Total Population 1961 No.	% of Punjab	1972 No.	% of Punjab	Change 1961-72 No.	%	Urban Population 1961 No.	% of total	1972 No.	% of total	Change 1961-72 No.	%
1 Highest	9	5,207,916	20.4	8,522,287	22.7	3,314,371	63.6	2,533,626	48.6	4,476,537	52.2	1,942,911	76.7
2	9	3,552,214	13.9	5,476,437	14.6	1,924,223	54.2	676,273	19.0	1,077,606	19.7	401,333	59.3
3	9	2,538,244	10.0	3,813,879	10.1	1,275,635	50.3	269,422	10.6	522,326	13.7	252,904	93.9
4	9	2,807,145	11.0	4,126,935	11.0	1,319,790	47.0	279,464	9.9	484,869	11.7	205,405	73.5
5	9	2,983,327	11.7	4,281,289	11.4	1,297,962	43.5	421,724	14.1	671,937	15.7	250,213	59.3
6	9	2,708,093	10.6	3,818,225	10.2	1,110,132	41.0	531,238	19.6	763,778	20.0	232,540	43.8
7	9	2,589,484	10.2	3,552,393	9.4	962,909	37.2	351,706	13.6	602,197	16.9	250,491	71.2
8 Lowest	10	3,101,106	12.2	4,018,714	10.6	917,608	29.6	397,080	12.8	583,445	14.5	186,365	46.9
PUNJAB	73	25,487,529	100.0	37,610,159	100.0	12,122,630	47.6	5,460,533	21.4	9,182,695	24.4	3,722,162	68.2

SOURCE : As in Table 3.20

In Lyallpur, Lahore and Multan tehsils the rapid population increase was associated with a combination of agricultural and industrial development, improved and expanded communications and increased commercial activity leading to rapid urbanization. The urban size of Lyallpur expanded by 137.4 per cent, Multan's by 88.4 and Lahore's by 52.6 during this period, so that in 1961, the urban population of these three cities constituted 8.2 per cent of the Province's total and 38.1 per cent of its urban population. The corresponding figures a decade earlier were 5.9 and 33.9 per cent.

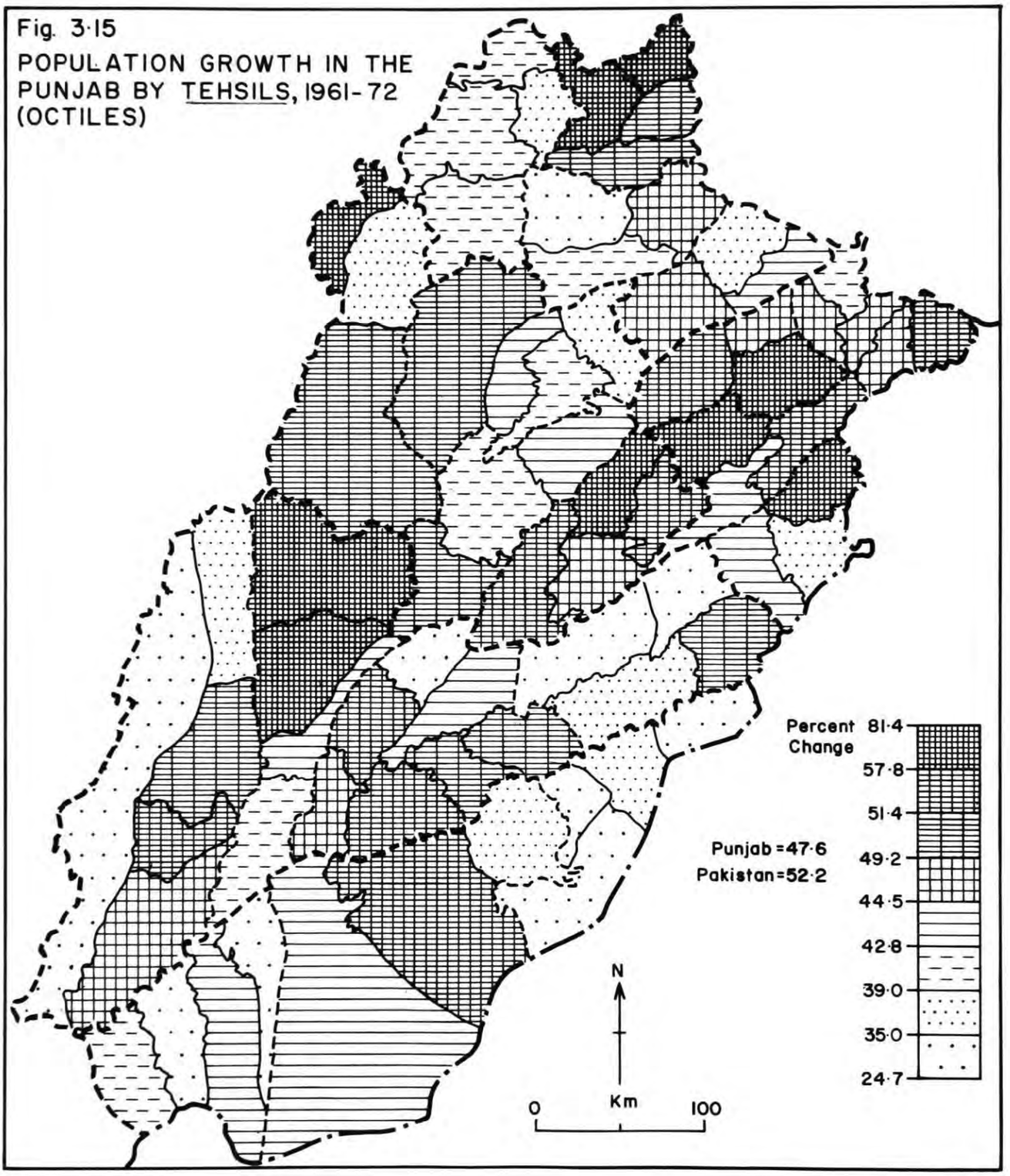
In sharp contrast to the nine rapidly expanding tehsils, the ten with the slowest rates of growth were Fatehjang, Pasrur, Campbellpur, Narowal, Chunian, Dipalpur, Shakargarh, Sialkot, Gujrat and Chakwal (Fig. 3.14). Here there was a limited agricultural potential and slower rate of urbanization connected with slow commercial activity and lack of industries. Fatehjang and Campbellpur lost some of their population to the adjacent new national capital territory while in the tehsils of the Sialkot district out-migration, partly due to their location on the sensitive Indo-Pakistan border and particularly their proximity to Kashmir, caused a decline in their population growth rates. Together these ten tehsils experienced a modest increase of 5.3 per cent between 1951 and 1961, and their share of the Provincial total dropped from 13.9 to 11.9 per cent (Table 3.20).

3.6.2. Spatial Variations in Population Growth, 1961-72

The most conspicuous feature of population growth during this period was its exceptionally rapid rate. Between 1961 and 1972, the population of the Punjab as a whole increased by 12.1 million or 47.6 per cent, compared with the whole country's 22.4 million or 52.2 per cent (Table 3.9). Thus, whereas in the case of Pakistan as a whole, this rate of growth was less than double of that in the previous intercensal period, in the Punjab, it was more than double. In 30 of the Punjab's 73 tehsils, growth rates were above the Provincial average and in 17 they exceeded the national rate of growth. In the great majority of tehsils,

Fig. 3·15

POPULATION GROWTH IN THE PUNJAB BY TEHSILS, 1961-72 (OCTILES)



the rates of population growth were well above those of the previous period, the only exceptions being Chishtian, Fort Abbas, Liaqatpur, Khanpur and Sadiqabad, where the rates of growth declined. In 22 tehsils, the 1961-72 rates were more than twice, in ten more than three times and in another ten more than four times those of 1951-61.

The highest rates of increase were shown by Leiah (81.4 per cent), Kot Addu (69.6), Gujranwala (67.1), Lyallpur (66.7), Rawalpindi (62.0), Isakhel (61.1), Murree (59.2), Lahore (59.2) and Sheikhupura (58.9)which together experienced an increase of 3,314,371 or 63.6 per cent. Their share of the Punjab's total climbed by 2.3 percentage points and their level of urbanization increased by almost 4 percentage points. Furthermore, although they did not experience the highest rate of urban change, they were responsible for more than half of the Province's urban population increase (Table 3.21).

In Leiah, the high rate of population growth was supported by a further realization of the tehsil's agricultural potential due to greater use of machinery and a faster reclamation of uninhabited land and also the introduction of agro-based, mainly sugar, industry. With the improvement and expansion of roads, commercial activity in the area received a boost and the influence of this development extended beyond the tehsil boundaries particularly into its southern neighbour, Kot Addu, which also experienced the highest rate of population growth in its history.

In Gujranwala and Sheikhupura, the high rate of population growth was linked with the revitalization of the economy by the eradication of the problems of waterlogging and salinity through Salinity Control And Reclamation Projects (SCARPs). As a result, large tracts of "ailing" land were recovered, increasing the cropped area and the productivity of land. The rapid population growth in these tehsils was also supported by a rapid rate of industrialization during Ayub Khan's regime (1958-69). Lahore-Gujranwala-Sheikhupura was one of the country's three principal industrial regions earmarked in the government's strategy of industrial development. The expansion of roads and the spectacularly

increased road transport during this period, provided a momentum to commercial activity. Rapid urbanization in these tehsils and in the adjoining tehsils of Lahore and Lyallpur wove these four tehsils into a near-continuous region of sharp population increase. Between 1961 and 1972, the urban population of Lyallpur mounted by 93.6 per cent, Lahore's by 67.4, Gujranwala's by 83.8 and Sheikhupura's by 93.5 per cent. Thus the four tehsils experienced a rise of 74.8 per cent in their urban population compared with 62.6 per cent in their total population.

The high rate of growth in Rawalpindi tehsil was linked, inter alia, with its rapid urbanization due to the transfer of the national capital in its near vicinity. The urban population of Rawalpindi city rose by 80.7 per cent and that of Wah cant., the tehsil's only other urban locality, by 190.3 per cent raising the tehsil's urban population by 91.5 per cent. The influence of this development was extended into the adjacent Murree tehsil which, with milder climate and new hill stations Ayubia and Khanspur, attracted in-migration especially from the capital area and parts of the NWF.

Isakhel's exceptionally high rate of growth,well reflected by its rapid urbanization, underscores the government's interest in the uplift of the area during the gubernatorial tenure of one of its residents. Between 1961 and 1972, Isakhel's urban population jumped by 77.5 per cent - against 19.6 per cent of the previous period and that of Kalabagh, the only other urban locality in the tehsil, rose by 43.5 per cent - compared with its previous fall of 13.8 per cent. On the whole, the tehsil's urban population increased by 59 per cent in the wake of a reinvigorated road transport system which strengthened the hitherto weak link with the other parts of the Province and thus facilitated an easy inflow of goods and services. The introduction of irrigation, though on a limited scale, helped to improve the agricultural productivity and arrest out-migration.

The ten tehsils with the lowest level of population change together

increased their population by 29.6 per cent and, although their level of urbanization increased by 1.7 percentage points, their share of the Province's total population fell from 12.2 per cent in 1961 to 10.6 in 1972 (Table 3.21). The slow rate of population increase in these tehsils may be attributed to their slackened agricultural activity, mainly due to the shift of cultivators' interest towards other relatively more productive areas and also, in the case of Minchinabad, Chishtian, Fort Abbas, Baluch Tract and Chakwal, owing to their position remote from the main lines of communications (Fig. 3.15).

3.7. URBAN - RURAL DIFFERENTIAL IN POPULATION GROWTH

Pakistan has a predominantly agricultural economy and the great bulk of its population lives in villages. These features are equally characteristic of its principal provice, the Punjab, which contains 57.6 per cent of the country's total and 58.4 per cent of its rural population. However, despite the traditionally rural character of the region, there is clear evidence of change, particularly during the last few decades. The accelerated growth of urban localities, the concentration of population into ever larger urban agglomerations and the expansion of industrial and commercial activities are reflected in the growing urbanization of Pakistan particularly since Independence. The Punjab is no exception to these trends which are so characteristic of the Third World at the present time.

The rapid urbanization i.e. the progressive concentration of people in the urban localities, has not only caused a large scale redistribution but has also influenced many other characteristics of Pakistan's population. There exists, in fact, a strong residential differential in the region's population growth rates. In order to obtain a realistic picture of the Punjab's population change, therefore, it is appropriate to make an appraisal of the differential growth in the Province's urban and rural populations.

3.7.1. Levels and Trends of Urbanization

The classification of settlements and their populations into urban and

rural categories is a major aspect of population studies. A major problem here is that of the criteria used by individual countries which differ widely and add to the difficulties of international comparisons. In the absence of a universally accepted criterion, yet maintaining a sense of comparability, the 1951 Census of Pakistan used both population size and the form of administrative organization (municipalities, civil lines and cantonments) as the basis for the division of the population into urban and rural components. Accordingly, all places having a population of 5,000 and above were classed as urban. In addition, all incorporated municipalities and towns managed by Notified Area Committees were treated as urban for "census purposes", despite the smaller size of some of the settlements in this category. (103)

In 1961, the earlier definition of "urban" was maintained except that, additionally, the Provincial Directors of Census were authorized to treat as urban an agglomeration of houses with fewer than 5,000 persons but having pronounced urban characteristics such as common utilities, roads, schools and, inter alia, a substantial non-agricultural population. (104) In 1972, the same criteria were maintained. Thus it is obvious that urban settlements are not a constant set of areas and, therefore, the region's urban growth during any period inevitably includes an element of reclassification of settlements.

The intricacies of definitions aside, Pakistan's urban population, like those of most Third World countries, has mounted at a spectacular rate since the early years of the twentieth century. The level of urbanization in the country has been steadily climbing during this period and in 1972 it was more than 2½ times that of 1901. In 1901, the percentage of Pakistan's population living in urban agglomerations was 9.8; by 1972, it had jumped to 25.4. The acceleration in urban growth and the associated expansion of commerce and industries in view, the country's urban population is bound to rise further. It is estimated that Pakistan's urban population will increase to 86.1 million by 2001 so as to constitute almost two thirds of the nation's total population. (105)

The Punjab maintained a close association with the national rates during all these years but its level of urbanization surpassed that of the country as a whole only in 1911, 1931 and 1941 (Table 3.23). In 1901, 9.1 per cent of the Punjab's population was classed as urban; by 1972, it had increased to 24.4 per cent. The increase of only 15.6 percentage points in almost three quarters of a century appears deceptively small; but when it is considered that this "minuscule" change in the level of urbanization was effected by an 877.7 per cent increase in the Province's urban population between 1901 and 1972, adding over eight million urban-dwellers to less than one million of 1901, the increase in the level of urbanization assumes different dimensions.

Table 3.22 points out the change in Pakistan's urban population by provinces and major administrative units between 1951 and 1972. As is evident, in 1972 the Punjab contained more than half (55.3 per cent) of Pakistan's total urban population but ranked third among the country's major administrative divisions in terms of the level of urbanization. This, in a way, is misleading since the two areas with higher levels of urbanization - Sind and the Federal Capital Territory - are special cases. In Sind, the level of urbanization has been inflated by the presence of Karachi, a city of 3,498, 635 people with national rather than provincial significance, while the Federal Capital Territory is a relatively small area containing only the capital city of Islamabad. The Punjab, on the other hand, with over half of Pakistan's urban places (202 out of 384) and over half of its urbanites, has a broader distribution of urban population and places than other provinces and thus the most completely developed urban system in the country.

Table 3.23 indicates the level of urbanization in the Punjab by divisions and districts at the time of different censuses from 1901 to 1972. As is clear, in 1901 seven districts had their level of urbanization higher than that of the Province as a whole; while in 1972 this number dropped to four - possibly due to greater urban concentration and higher rate of urban growth in fewer places. Lahore district, because of the metropolis Lahore, maintained its high urbanization

TABLE 3.22 GROWTH OF URBAN AND RURAL POPULATION IN PAKISTAN BY PROVINCES, 1951-72

Territory	Urban Population													Rural Population								
	1951 Population			1961 Population			Change		1972 Population			Change		1951 Population		1961 Population		Change		1972 Population		Change	
	No.	% of Pak.	% of Tot.	No.	% of Pak.	% of Tot.	No.	%	No.	% of Pak	% of Tot.	No.	%	No.	% of Pak.	No.	% of Pak.	No.	%	No.	% of Pak	No.	%
Punjab	3,586,930	59.8	17.4	5,460,533	56.7	21.4	1,873,603	52.2	9,182,695	55.3	24.4	3,722,162	68.2	17,064,210	62.1	20,026,996	60.2	2,962,786	17.4	28,427,464	58.4	8,400,468	41.9
Sind	1,768,494	29.4	28.8	3,167,018	32.9	37.9	1,398,524	79.1	5,725,776	34.5	40.5	2,558,758	81.0	4,366,556	15.9	5,200,047	15.6	833,491	19.1	8,430,133	17.3	3,230,086	62.1
NWF	501,695	8.4	12.2	757,710	7.8	13.2	256,015	51.0	1,195,655	7.2	14.3	437,945	57.8	3,609,765	13.1	4,973,281	14.9	1,363,516	37.8	7,192,896	14.7	2,219,615	44.6
Baluchistan	145,256	2.4	12.2	228,468	2.4	16.9	83,212	57.3	399,584	2.4	16.5	171,116	74.9	1,041,381	3.8	1,125,016	3.4	83,635	8.0	2,029,094	4.2	904,078	80.4
FCTI	x	x	x	x	x	x	x	x	76,641	0.5	32.6	76,641	-	83,170	0.3	119,307	0.4	36,137	43.4	158,172	0.3	38,865	32.6
FATA	x	x	x	22,953	0.2	1.2	22,953	x	13,300	0.1	0.5	- 9,653	-42.1	1,332,005	4.8	1,824,242	5.5	492,237	36.9	2,477,930	5.1	653,688	35.8
PAKISTAN	6,002,375	100.0	17.9	9,636,682	100.0	22.5	3,634,307	60.6	16,593,651	100.0	25.4	6,956,969	72.2	27,497,087	100.0	33,268,889	100.0	5,771,802	21.0	48,715,689	100.0	15,446,800	46.4

x Not available

SOURCE : Computed from: District Census Reports 1972 (52 vols)

level - 64.2 per cent in 1972 followed by Rawalpindi (44.2 per cent) whose high urbanization level is due to the presence of Rawalpindi city, which enjoys "primacy" in the rain-fed Potwar region;while Lyallpur district, despite containing the Province's second and the nation's third largest urban place, maintains a lower level of urbanization due mainly to a sizeable rural population on the district's fertile productive land.

A broader understanding of the marked regional differences in the degree or urbanization is offered by Figure 3.16 in which the 1972 level of urbanization has been plotted by tehsils. The highest level is shown by Lahore tehsil (85.0 per cent) followed closely by Rawalpindi (72.7), Lyallpur (49.2) and Multan (48.3). At the other end of the scale, five tehsils with less than 5 per cent of their population classed as urban are : Kahuta (3.7 per cent), Samundri (4.1), Liaqatpur (4.2) and Shakargarh (4.5),in addition to Baluch Tract which is devoid of urban population.

3.7.2. Patterns of Urban Population Growth

Urban and rural populations of the Punjab at divisional and district level for each census from 1901 to 1972 are given in Appendices I and II; urban and rural populations at the tehsil level for the post-Independence period are given in Appendices IV and V. The rates of change in the total, urban and rural populations of the Province for the various intercensal periods since 1901 are presented by the constituent divisions and districts in Table 3.24, which facilitates comparisons between the three rates.

Between 1901 and 1972, the Province experienced an increase of 877.7 per cent in its urban population compared with 264.7 per cent in the total and 203.2 in the rural population. Thus the growth rate of urban population during this period was more than four times as rapid as that of the rural population. Indeed the difference between the two growth rates has almost always been very large and a glance at Table 3.24 will bring home the point that, in almost all divisions

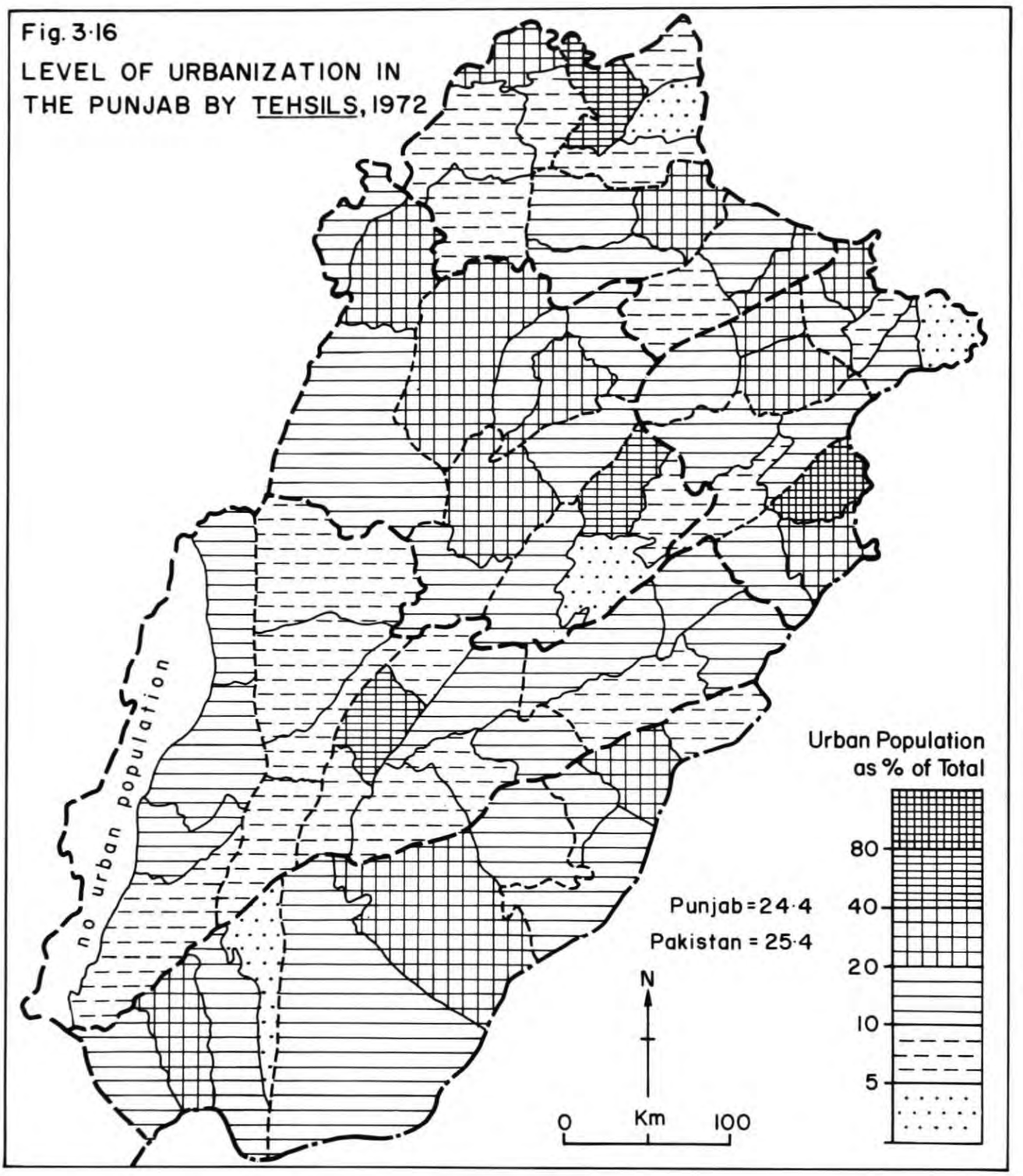


Fig. 3·16
LEVEL OF URBANIZATION IN
THE PUNJAB BY TEHSILS, 1972
no urban population
Urban Population
as % of Total
80
40
20
10
5
Punjab = 24·4
Pakistan = 25·4
N
0
Km
100

TABLE 3.23 LEVEL OF URBANIZATION IN THE PUNJAB BY DIVISIONS AND DISTRICTS, 1901-72

(Percent of total Population)

Division/District	1901	1911	1921	1931	1941	1951	1961	1972	Change 1901-51	Change 1951-72	Change 1901-72
I. Rawalpindi Div.	8.1	8.4	9.2	10.1	12.6	16.0	19.4	23.6	+ 7.9	+ 7.6	+15.5
1. RWP	16.0	16.1	18.4	19.1	23.9	31.7	36.7	44.2	+15.7	+12.5	+28.2
2. CPR	4.6	5.7	6.3	8.4	9.0	8.3	10.3	12.5	+ 3.7	+ 4.2	+ 7.9
3. JLM	7.0	7.2	7.4	7.9	9.0	11.3	14.1	16.0	+ 4.3	+ 4.7	+ 9.0
4. GJT	5.3	5.5	5.6	6.2	8.7	11.0	12.7	14.7	+ 5.7	+ 3.7	+ 9.4
II. Sargodha Div.	7.3	6.6	8.1	9.8	11.2	14.6	19.6	23.0	+ 7.3	+ 8.4	+15.7
5. SRG	11.4	8.8	10.3	12.1	13.5	18.4	19.4	23.5	+ 7.0	+ 5.1	+12.1
6. MWI	6.2	7.6	8.4	9.3	10.4	10.6	19.0	21.6	+ 4.4	+11.0	+15.4
7. JNG	9.4	7.6	10.0	11.6	12.4	15.4	16.0	18.2	+ 6.0	+ 2.8	+ 8.8
8. LYP	2.8	4.0	5.1	7.3	9.1	13.2	21.4	24.8	+10.4	+11.6	+22.0
III. Lahore Div.	11.8	13.5	14.7	20.1	24.6	28.6	34.0	37.0	+16.8	+ 8.4	+25.2
9. LHR	26.7	29.7	32.0	40.6	49.6	51.8	59.1	64.2	+25.1	+12.4	+37.5
10. SLT	6.6	8.3	8.0	11.0	12.6	15.0	16.0	16.4	+ 8.4	+ 1.4	+ 9.8
11. GWA	9.9	10.1	12.2	15.8	19.7	23.5	26.2	28.7	+13.6	+ 5.2	+18.8
12. SHA	0.9	0.8	1.2	4.7	6.3	9.0	12.7	14.8	+ 8.1	+ 5.8	+13.9
IV. Multan Div.	8.6	7.9	7.3	8.6	10.2	11.8	14.9	16.1	+ 3.2	+ 4.3	+ 7.5
13. MTN	15.5	13.2	11.1	11.8	14.3	16.2	21.4	22.1	+ 0.7	+ 5.9	+ 6.6
14. SWL	3.0	3.3	3.2	5.3	6.9	8.5	11.2	13.7	+ 5.5	+ 5.2	+10.7
15. MZG	4.0	4.0	4.6	5.2	5.9	7.2	7.4	7.7	+ 3.2	+ 0.5	+ 3.7
16. DGK	8.7	8.4	9.3	11.4	12.4	11.9	12.6	12.9	+ 3.2	+ 1.0	+ 4.2
V. Bahawalpur Div.	5.8	4.8	4.0	3.7	8.7	10.5	13.8	16.7	+ 4.7	+ 6.2	+10.9
17. BWP	16.0	12.3	11.8	11.0	17.4	17.0	18.8	21.0	+ 1.0	+ 4.0	+ 5.0
18. BWN	0.0	0.0	0.0	0.0	5.3	8.0	12.5	15.3	-	+ 7.3	-
19. RYK	3.3	3.2	1.5	1.5	5.0	7.8	11.2	14.6	+ 4.5	+ 6.8	+11.3
PUNJAB	9.1	9.1	9.7	12.0	14.7	17.4	21.4	24.4	+ 8.3	+ 7.0	+15.3
PAKISTAN	9.8	8.7	9.8	11.8	14.2	17.9	22.5	25.4	+ 8.1	+ 7.5	+15.6

SOURCES : computed from 1. Census of Pakistan 1961

2. District Census Reports 1972 (19 vols.)

and districts, the growth rate of urban population during any intercensal period far excelled that of rural population. The only major exception in terms of the period was 1901-11, when urban populations in five districts declined spectacularly, as did their total populations, due to the widespread plague and other epidemics (Section 3.2). Davis (1951) suggests that the decline in the pace of urbanization between 1901 and 1911 was due not so much to high mortality in the urban localities, as to the temporary evacuation of towns. (106) Many people fled from the congested, disease-stricken urban localities to the less pernicious airy precincts of the countryside.

By 1921, the towns were experiencing accelerated growth in their populations and, during the period 1921-31, the growth rate of urban population was more than thrice that of rural population (Table 3.24), and could be even higher if the effects of economic depression on the region's economy were lessened. The growth between 1931 and 1941 was exaggerated due to underenumeration and overenumeration of the two censuses respectively (Section 1.6), yet the pace of urbanization is believed to have accelerated in the wake of stabilization of the region's economy. It has been suggested that this sharp rise was, inter alia, due to British Punjab's anti-moneylender legislation which compelled the moneylender bunya class to move to urban places with their capital. (107) The investment of this capital in towns, in turn, boosted the development of industry, trade and commerce which acted as a catalyst for urbanization.

During the period 1941-51, the process of urbanization kept its previous tempo but significant increase in the Province's urban population was also caused by the influx of muhajirs. Those coming from the "agreed areas" of East (Indian) Punjab, having got land, settled both in villages and towns; whereas those coming from "non-agreed" areas preferred to live in urban places. (108) According to a study, there was a high correlation ($r = +0.875$) between the percentage increase of urban population during 1941-51 in places with over 50,000 population in 1951 and "displaced" people in these places as a percentage of the 1941 population. (109)

Between 1951 and 1961, the Punjab's urban population rose by 52.2 per cent - from 3,586,930 to 5,460,533. This was in sharp contrast to the growth rates of total and rural population, 23.4 and 17.4 per cent respectively. Further, all the three rates of the Province's population growth were lower than those of Pakistan as a whole (Table 3.24). The rate of urban population growth exhibited marked regional contrasts and eight of the Punjab's 19 districts experienced higher rates than the Province as a whole, in four the growth exceeded 100 per cent; while amongst tehsils, 27 showed higher than the Provincial rate, in 12 it exceeded 100 per cent (Appendix IV).

The region's rapid urban growth during the period 1951-61, was commensurate with its improved economic climate. The rapid reforms in agriculture, industry, communications and other fields initiated mainly towards the end of the period, during Ayub Khan's regime (post 1958), started paying dividends. The beginning of planned development and the installation of specialized agencies for development in various fields such as the Pakistan Industrial Development Corporation (PIDC), Agricultural Development Corporation (ADC), Water And Power Development Authority (WAPDA), Agricultural Development Bank of Pakistan (ADBP) and Pakistan Industrial Development Bank (PIDB),led to accelerated economic development. As a result, Pakistan's GNP increased at an average annual rate of 3.2 per cent between 1951 and 1961 (Section 5.2).

Improvement in the economic climate gave a fillip to population redistribution in the region. Migration from rural to urban areas and from small towns to large agglomerations is a universal phenomenon in the Third World,which usually operates with the two forces of "push" and "pull" - the "pull" from the cities is often superimposed on a "push" from the countryside. In Pakistan too, industrialization, increased job opportunities and an overall better life style in the towns acted as "magnet" whereas the lack of modern necessities of life accompanied by the worsening socioeconomic climate of the villages became a repellent force.

Data showing the components of population growth - natural increase and migration - separately are lacking; which makes it impossible to ascertain the exact role of each. However, in an attempt to measure the quantum of rural-urban migration, it was discovered, through the application of the census survival ratio approach to age data, that there were about 1.25 million net in-migrants of age 10 and over to the urban centres of Pakistan between 1951 and 1961. (110) This constituted 34.4 per cent of the country's total urban growth during that period and thus underscores the importance of rural-urban migration in the process of urbanization.

During the period 1961-72, the region experienced an unprecedented urban growth when Pakistan as a whole experienced an increase of 72.2 per cent in its urban population, at an average rate of 4.8 per cent per year; whereas the Punjab increased its urban-dwellers from 5,460,533 to 9,182,695 - by 68.2 per cent, at a compound annual rate of 4.6 per cent, compared with 4.3 per cent during the preceding period.

As before, the Punjab was the scene of striking regional variations in its urban growth and whereas no district experienced an intercensal rate below 50 per cent, seven districts increased their urban populations at a faster rate than did the Province as a whole (Table 3.24). The highest district level rate was shown by Rawalpindi (89.9 per cent), followed by Lyallpur (83.7) and Sheikhupura (79.9). At tehsil level, the contrasts were much more spectacular - 31 tehsils experienced higher than the Provincial growth rate. The highest growth rates were experienced by Shorkot (313.8 per cent), Dipalpur (222.3) and Daska (174.8) mainly because of new "upgraded" towns. In all, in ten tehsils, the rate exceeded 100 per cent,while the lowest rates were shown by Sialkot (21.7 per cent) and Pind Dadan Khan (24.1) (Appendix IV). The accelerated pace of urbanization during the period 1961-72 was in line with the country's brisk economic progress as a result of which the GNP rose at a compound rate of 6.1 per cent per year (Section 3.2). The highest rates of urban population increase were experienced in the areas where major developmentsin agriculture, industry, trade and commerce

TABLE 3.24 INTERCENSAL RATES OF CHANGE IN TOTAL, URBAN AND RURAL POPULATIONS OF THE PUNJAB BY DIVISIONS AND DISTRICTS, 1901-72

Territory	1901-11			1911-21			1921-31			1931-41			1941-51			1951-61			1961-72			1901-51			1951-72			1901-72		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
RWP DIV	2.2	5.2	1.9	0.7	10.2	-0.2	12.6	24.1	11.4	19.2	48.3	15.9	7.6	37.1	3.4	13.0	36.8	8.4	46.2	78.4	38.5	48.5	192.5	35.7	65.2	144.0	50.2	145.2	613.8	103.8
RWP	-1.9	-1.5	-2.0	3.9	18.4	1.1	11.4	16.1	10.4	23.8	54.6	16.5	15.7	53.6	3.8	22.1	41.2	13.3	57.5	89.8	38.9	62.6	221.6	32.2	92.4	168.0	57.3	212.8	761.8	108.0
CPR	11.8	39.8	10.5	-1.4	7.9	-1.9	14.0	52.7	11.4	15.7	23.7	15.0	2.1	-5.6	2.9	1.5	25.6	-0.7	40.2	70.6	36.7	48.6	169.0	42.9	42.2	114.3	35.7	111.4	476.3	93.9
JLM	2.0	4.0	1.9	-6.7	-3.4	-7.0	13.4	21.1	12.8	16.4	31.7	15.1	8.3	36.8	5.5	9.8	36.6	6.4	40.4	59.4	37.3	36.0	119.3	29.7	54.2	117.8	46.1	109.8	377.5	89.5
GJT	-0.5	3.0	-0.7	4.6	6.7	4.5	11.9	24.5	11.2	19.8	68.2	16.6	4.9	32.2	2.3	14.4	32.0	12.3	43.2	66.0	39.9	46.3	204.0	37.5	63.9	119.1	57.1	139.7	566.0	115.9
SRG DIV	30.3	18.9	31.1	11.5	35.5	9.8	17.1	42.3	14.9	21.5	38.4	19.7	27.4	66.2	22.5	26.0	69.9	18.5	50.6	76.3	44.3	163.2	427.5	142.5	89.7	199.6	71.0	399.3	1480.3	314.7
SRG	32.1	1.0	36.2	11.6	31.6	9.7	14.1	34.3	11.8	21.6	35.0	19.7	16.4	58.7	9.8	26.2	33.1	24.6	43.2	73.6	35.8	138.2	282.5	119.6	80.7	131.1	69.3	330.4	783.9	271.8
MWI	13.1	38.4	11.4	4.9	15.3	4.1	14.9	27.4	13.8	23.0	37.6	21.5	8.7	10.9	8.5	35.6	144.3	22.8	46.7	66.0	42.2	82.3	210.2	73.9	99.0	305.6	74.6	262.9	1157.9	203.6
JNG	23.1	-0.2	25.5	8.7	42.5	5.9	16.5	35.0	14.5	23.6	32.2	22.5	6.7	33.0	3.0	23.0	27.7	22.2	44.7	64.8	40.9	105.7	237.7	92.0	78.0	110.4	72.1	266.2	610.6	230.5
LYP	42.7	105.8	40.9	15.7	49.6	14.3	20.5	71.5	17.8	19.7	48.2	17.4	54.2	124.1	47.2	24.7	102.5	12.9	58.0	83.7	51.1	267.4	1652.9	228.1	97.0	272.0	70.5	623.8	6421.4	459.6
LHR DIV	-6.2	6.8	-7.9	7.6	17.2	6.1	15.6	58.1	8.3	22.9	50.8	15.9	12.2	30.6	6.2	20.8	43.5	11.6	52.5	65.9	45.6	60.8	289.8	30.1	84.2	138.1	62.5	196.2	828.1	111.5
LHR	-0.4	11.1	-4.6	13.0	21.6	9.4	21.1	53.8	5.7	24.7	52.4	5.8	25.3	30.6	20.0	30.8	49.4	11.0	52.2	65.3	33.3	112.9	313.2	40.1	99.1	146.9	47.9	323.9	920.2	107.2
SLT	-7.3	15.6	-9.0	0.8	-2.6	1.1	12.5	54.8	8.8	20.8	38.3	18.6	-0.5	18.2	-3.2	8.3	15.5	7.0	46.8	50.6	46.1	26.3	184.9	15.0	59.0	74.0	56.4	100.7	395.6	79.8
GWA	-18.1	-16.2	-18.3	3.0	23.6	0.6	18.1	52.8	13.2	23.9	54.8	18.1	14.8	36.8	9.4	23.4	37.6	19.0	59.4	74.8	54.0	41.6	235.5	28.3	96.7	140.6	83.3	178.5	707.2	120.5
SHA	3.3	0.2	3.3	17.4	69.9	16.9	9.8	331.4	5.9	22.4	63.8	20.4	8.3	53.5	5.3	17.0	65.4	12.3	53.4	79.9	49.5	76.5	1746.6	62.0	79.5	197.6	67.9	216.7	5395.8	172.0
MTN DIV	10.6	1.4	11.4	10.4	1.4	11.2	24.4	46.6	22.7	26.8	51.0	24.5	27.9	47.8	25.6	24.5	57.7	20.0	44.7	56.0	42.7	146.4	236.4	137.9	80.0	146.0	71.2	343.6	727.7	307.3
MTN	14.5	-2.8	17.6	9.7	-8.0	12.4	31.9	41.3	30.7	28.0	54.8	24.4	42.0	60.6	38.9	28.2	69.0	20.3	48.3	53.2	47.0	201.0	214.1	198.6	90.1	158.9	76.9	472.3	713.3	428.0
SWL	12.2	25.4	11.8	42.3	36.0	42.5	45.8	141.0	42.7	32.9	73.2	30.7	36.6	70.1	34.2	17.5	54.6	14.1	32.9	62.3	29.2	322.7	1110.2	298.5	56.2	150.9	47.4	560.2	2936.4	487.3
MZG	7.9	7.1	8.0	-0.2	14.5	-0.8	4.0	18.8	3.3	20.5	36.7	19.6	5.4	28.7	3.9	31.8	34.2	31.6	58.1	64.3	57.6	42.4	156.2	37.6	108.3	120.5	107.4	196.6	465.1	185.3
DGK	6.6	2.0	7.0	-6.2	4.4	-7.1	5.0	28.9	2.6	19.4	29.9	18.0	1.5	-2.9	2.1	23.1	29.9	22.2	47.1	50.8	46.6	27.2	73.3	22.8	81.1	95.9	79.2	130.4	239.4	120.0
BWP DIV	8.3	-11.9	9.5	0.1	-16.5	0.9	26.0	17.8	26.4	36.2	218.9	29.2	35.9	65.1	33.2	41.2	84.8	36.1	37.7	67.1	33.0	152.9	356.3	140.3	94.4	288.9	80.9	391.6	1309.4	334.7
BWP	8.3	-16.7	13.1	0.1	-4.1	0.7	26.0	16.8	27.3	36.2	116.1	26.4	35.9	32.8	36.6	39.3	54.4	36.2	45.6	62.5	41.7	152.9	167.7	150.1	102.9	150.8	93.1	413.1	571.4	382.8
BWN	8.3	-	8.3	0.1	-	0.1	26.0	-	26.0	36.2	-	29.0	35.9	107.3	32.0	30.5	103.0	24.2	30.5	59.9	26.3	152.9	-	132.6	70.3	224.5	56.8	330.7	-	264.8
RYK	8.3	6.7	8.3	0.1	-54.2	1.9	26.0	24.2	26.1	36.2	366.3	31.3	35.9	112.5	31.9	52.8	119.8	47.2	37.7	79.2	32.5	152.9	501.8	141.1	110.5	293.9	95.0	432.3	2270.8	370.0
PUNJAB	6.6	6.2	6.6	7.0	14.4	6.3	18.0	45.7	15.0	23.7	51.8	19.9	20.3	42.0	16.5	23.4	52.2	17.4	47.6	68.2	41.9	100.2	281.9	82.0	82.1	156.0	66.6	264.7	877.7	203.2
PAKISTAN	16.9	4.3	18.3	8.9	21.9	7.7	11.5	34.6	9.0	20.1	45.0	16.8	18.5	49.9	14.4	28.1	60.6	21.0	52.2	72.2	46.4	102.1	270.7	83.8	94.9	176.5	77.2	294.0	924.9	225.7

1. Rate of Change of Total Population (%)
2. Rate of Change of Urban Population (%)
3. Rate of Change of Rural Population (%)

SOURCES : Computed from Sources given in Table 3.23

and communications had taken place. The slow rates of growth, on the other hand, were experienced by the areas which were removed from the major communication arteries and their isolation had become injurious to the process of development.

A broader understanding of the change in the Province's urban population since 1901, may be acquired by looking at the varying degree of concentration in the urban agglomerations of different sizes given by Table 3.25. The varying percentage of different size classes is charted in Figure 3.17.

With a broader spectrum of urban centres and a fair dispersal of population in them, the Punjab has a more complete urban hierarchy than the other provinces and its urban population is less concentrated by size classes than that of the country as a whole - the coefficient of urban concentration (Gi) for the Punjab being +0.696 compared with Pakistan's +0.741 in 1972. (111)

An examination of Figure 3.17 reveals that there has been a marked degree of fluctuation in the population share of various size classes during the period 1901-72. The most spectacular change is manifested by the 25,000-49,999 and 100,000+ classes,both of which made great strides with the result that their share of the Province's urban population rose from 4.1 to 11 per cent and 21.6 to 62 per cent respectively,between 1901 and 1972. If the growth between 1901 and 1972 is evened out, the compound annual rate of growth for these classes will be 4.7 and 4.8 per cent respectively, compared with 1.8 and 3.2 per cent of the Province's total and urban populations. The overall change in these two classes between 1901 and 1972 was 2,537 and 2,705 per cent respectively, versus the Province's total urban population growth of almost 878 per cent.

Concomitant with these increases were the phenomenal decreases in the share of other size classes particularly 50,000-99,999, 5,000-9,999 and below 5,000. The last mentioned with 15 places in 1901 contained 5.9 per cent of the Province's urbanites; but in 1972, with 16 places, its share had declined to a mere 0.6 per cent (Table 3.25).

Fig. 3·17
CHANGING PROPORTION OF URBAN POPULATION IN DIFFERENT SIZED URBAN LOCALITIES IN THE PUNJAB, 1901-1972

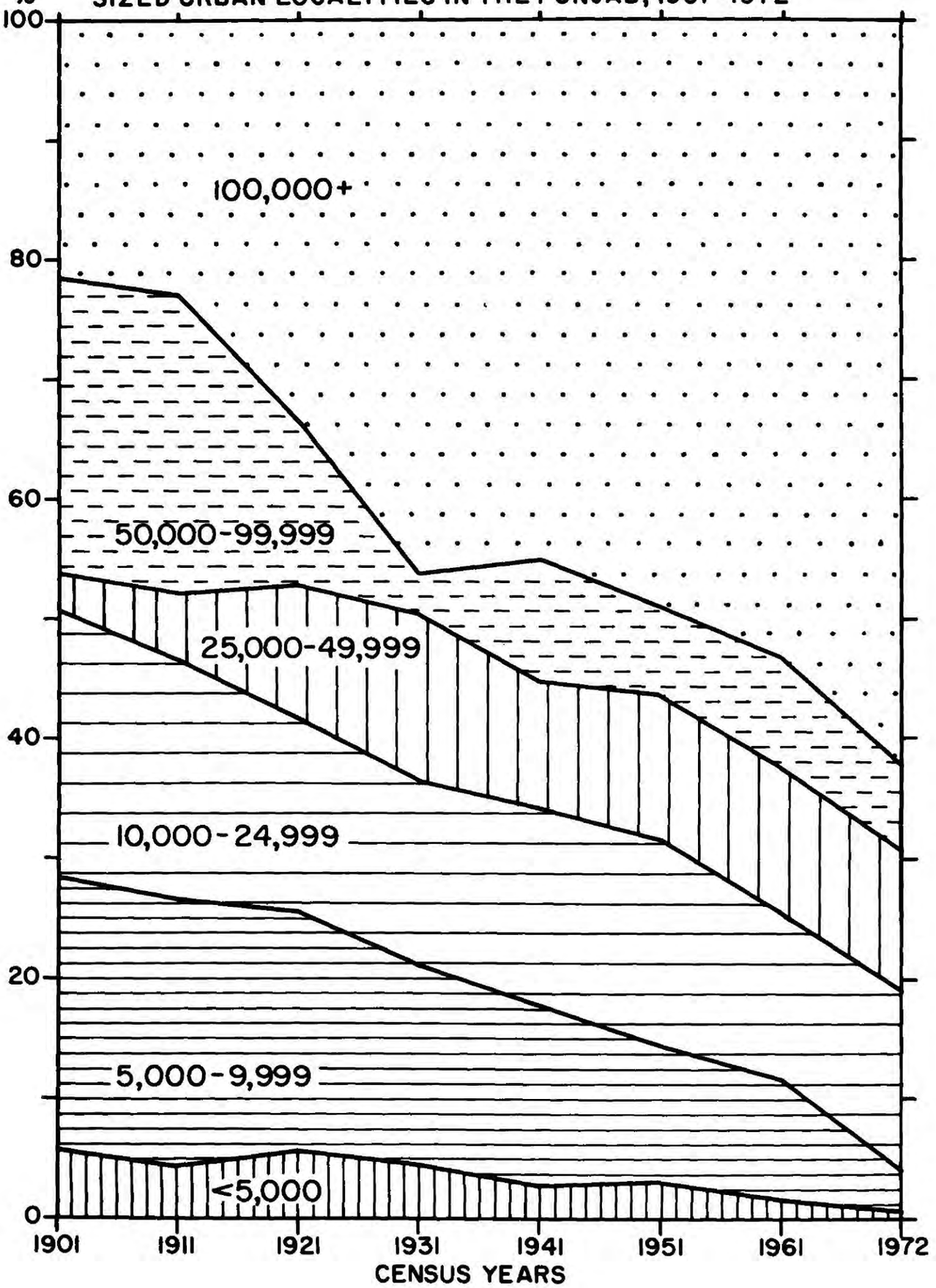


TABLE 3.25 DISTRIBUTION OF URBAN POPULATION IN THE PUNJAB BY SIZE OF URBAN LOCALITIES, 1901-72

Urban Size	1901			1911			1921			1931		
	No. of Places	Population No.	%	No. of Places	Population No.	%	No. of Places	Population No.	%	No. of Places	Population No.	%
< 5,000	15	54,941	5.9	13	42,683	4.3	17	63,829	5.6	20	73,733	4.4
5,000-9,999	29	199,524	21.2	30	221,690	22.2	32	227,053	19.9	38	274,376	16.5
10,000-24,999	12	210,289	22.4	12	198,806	19.9	11	185,574	16.3	17	256,282	15.4
25,000-49,999	1	38,423	4.1	2	55,386	5.6	4	127,180	11.1	7	231,049	13.9
50,000-99,999	3	233,038	24.8	3	250,595	25.1	2	155,425	13.6	1	58,716	3.5
100,000 and over	1	202,964	21.6	1	228,687	22.9	2	382,923	33.5	4	769,461	46.3
TOTAL	61	939,179	100.0	61	997,847	100.0	68	1,141,984	100.0	87	1,663,617	100.0

TABLE 3.25 (Cont.)

Urban Size	1941			1951			1961			1972		
	No. of Places	Population No.	%	No. of Places	Population No.	%	No. of Places	Population No.	%	No. of Places	Population No.	%
< 5,000	21	60,459	2.4	28	109,497	3.1	23	85,694	1.6	16	56,778	0.6
5,000-9,999	53	383,599	15.2	53	397,401	11.1	69	524,379	9.6	40	312,063	3.4
10,000-24,999	29	413,756	16.4	41	593,950	16.5	50	761,791	14.0	92	1,400,044	15.3
25,000-49,999	8	272,525	10.8	12	419,965	11.7	19	666,263	12.2	29	1,013,220	11.0
50,000-99,999	4	257,627	10.2	5	321,753	9.0	7	509,566	9.3	11	706,696	7.7
100,000 and over	4	1,138,177	45.0	6	1,744,364	48.6	7	2,912,840	53.3	14	5,693,894	62.0
TOTAL	119	2,526,143	100.0	145	3,586,930	100.0	175	5,460,533	100.0	202	9,182,695	100.0

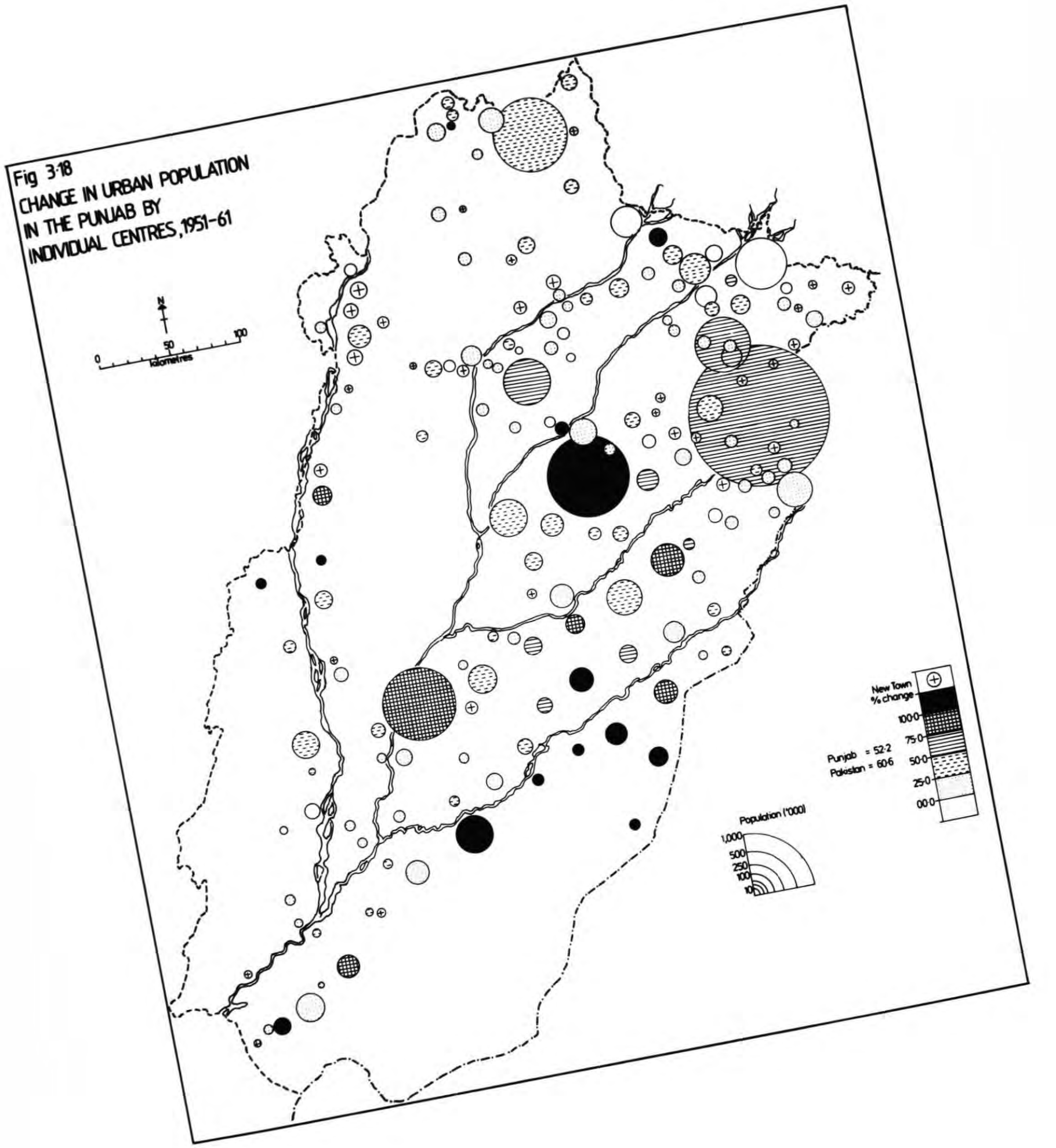
SOURCES: computed from 1. Census of Pakistan 1961.
2. District Census Reports 1972 (19 vols)

A more lucid picture of urban growth is provided by Figures 3.18 and 3.19 which depict the changes in the individual urban centres for the 1951-61 and 1961-72 periods respectively. As is evident, the greatest concentration of urban centres is in the Rechna Doab where 48 urban places contained 27.3 per cent of the Province's 1972 urban population. Similarly, Bari Doab, with the metropolis of Lahore and 39 other urban places, contained 40.2 per cent; the Potwar region with Rawalpindi plus 22 other places, 11.6 per cent; the Chaj Doab with 27 places, 7.3 per cent; and the trans-Sutlej Bahawalpur division with 24 urban places constituted 6.5 per cent of the Province's urban population in 1972.

An examination of the Figures 3.18 and 3.19 further reveals that, in each period, the growth rate varied widely between different urban centres; and the numerical as well as percentage increase was higher during the latter period, at both the Provincial and the individual town level. Between 1951 and 1961, there were 15 towns whose population had actually declined, while in the succeeding period there was only one town - Badhana - off the major road and rail networks and near the Indian border, whose population declined by almost 37 per cent, from 4,624 to 2,924. The number of urban settlements with over 100 per cent increases was 14 and 15 during the two periods respectively. The reclassified settlements numbered 34 during the period 1951-61 with an aggregate population of 216,834 accounting for 11.6 per cent of the intercensal urban growth. However, during the succeeding period, the number of such "upgraded" places dropped to 27 and with 245,181 people constituted only 6.6 per cent of the urban change between 1961 and 1972.

The reclassified towns have, however, played a significant role in swelling the urban growth rates of their tehsils and districts and thus in influencing the regional contrasts of urban growth. For instance, they were largely responsible for the high rates in six of the 12 tehsils with over 100 per cent increases between 1951 and 1961 and for seven of the 10 such tehsils during the succeeding period. A somewhat similar role was played by cantonments. Creation of new cantonments and the population transfer between them had a great

Fig 3·18
CHANGE IN URBAN POPULATION
IN THE PUNJAB BY
INDIVIDUAL CENTRES, 1951-61



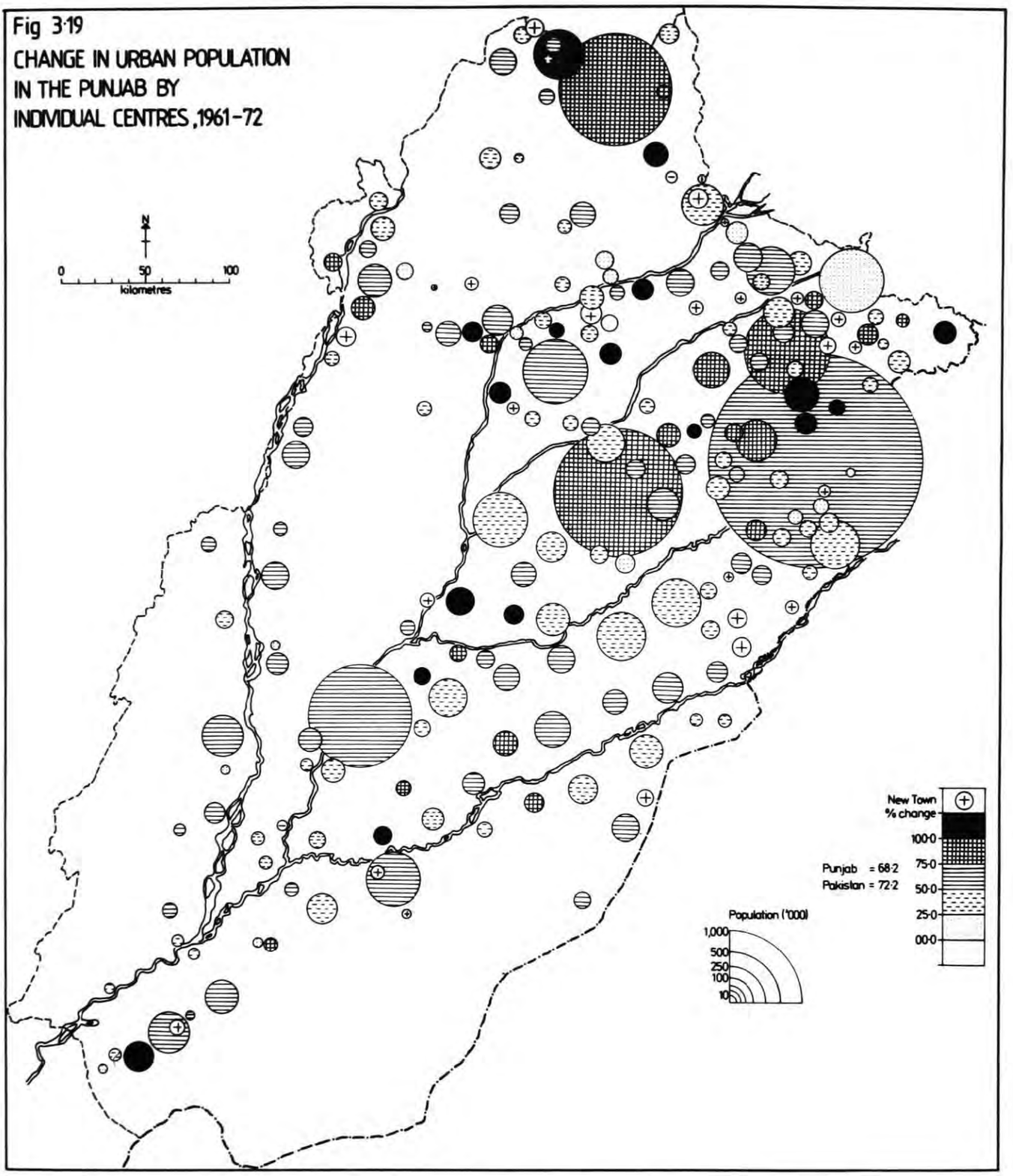


Fig 3·19
CHANGE IN URBAN POPULATION
IN THE PUNJAB BY
INDIVIDUAL CENTRES, 1961-72
N
0
50
100
kilometres
New Town
% change
100·0
75·0
50·0
25·0
00·0
Punjab = 68·2
Pakistan = 72·2
Population ('000)
1,000
500
250
100
10

bearing on the relative growth rates of the settlements with which these cantonments are linked. During the period 1961-72, for instance, the populations of Gujranwala, Shorkot, Multan and Okara gained and those of Murree, Jhelum, Kharian, Sargodha and Sialkot lost, due to this factor.

It is interesting to note from Figures 3.18 and 3.19 that the larger urban centres have generally experienced a higher growth rate during the last two periods, showing their propensity towards "metropolitanism". The number, size and differential growth of various urban settlements have not only determined the level of urbanization of their respective tehsils or districts but have also provided an impetus to the process of population redistribution in the region as a whole. Furthermore, since most such places drew in-migrants from all over the country, they also influenced the pattern of total population change in their respective regions. The five largest urban centres : Lahore, Lyallpur, Rawalpindi, Multan and Gujranwala caused to accumulate 51.6 per cent of the Province's urban and 20.3 per cent of its total population in only five tehsils which experienced a momentous growth of 73.6 and 61.7 per cent in their urban and total populations between 1961 and 1972.

3.7.3. Some Determinants of Urban Growth

Urbanization, sometimes viewed as an indicator of socioeconomic progress, is essentially a process of change and has a high degree of association with the economic development of a region. The distributional pattern of urban population confirms that even within the same country there is a strong connection between the levels of urbanization and of development. Any attempt to unravel the dynamics of urban growth in a region, therefore, must take cognizance of the changes in the economy of the region in question.

The growth of urban centres in Pakistan and their rapid expansion, especially since Independence, can be interpreted in terms of the country's progress in agriculture, industry, trade and commerce and other economic fields.

While industrialization and the expansion of commercial activity stimulated urban growth, the basis for it was provided by agricultural expansion. Emphasizing this fact, Hameed (1973) underscored the importance of perennial irrigation development in the region since the 1880's, which provided stimulus for the establishment of new settlements and also influenced the growth of earlier urban centres on a remarkable scale. (112) Hameed also identified four distinct periods of economic growth in the region; the preliminary (1881-1901), the planning (1901-31), the take-off (1931-51) and the growth period (post-1951); in each of which a close linkage between urbanization and agricultural change via irrigation expansion was demonstrated.

Another study explored the association between town development and agricultural change. Dividing Pakistan's agricultural sector into three geo-economic regions mainly on the basis of irrigation type, the study looked into the type and scale of urban growth in these regions and concluded that the nature of the agricultural hinterland plays an important role in the development of local urban areas. (113) According to this study, the rapidly growing large towns in the intensively irrigated Punjab Plain owe their expansion to their favourable location with respect to their flourishing agricultural hinterlands and their function of providing inputs for the new agricultural technology. The towns in the barani areas, on the other hand, are increasing their populations mainly with in-migration due to population pressure on their immediate hinterlands.

In order to investigate the impact of manufacturing activity on urban growth, a regression test was conducted between the 1972 population of the Punjab's 63 urban centres with 20,000+ population and the per capita manufacturing value added of the district in which they are located, which revealed a rather low positive correlation ($r = +0.42$) between the two variables. (114)

To round off this discussion, urban growth in a region during any period is a function of natural increase, net in-migration and, to some extent, reclassification and readjustment of town boundaries. It is argued that the urban localities have a lower rate of natural increase than the countryside (115)

and the readjustment of the town limits as also the reclassification in most cases is not bound to make a substantial difference. Thus it follows that rural-urban and intra-urban migration play a dominant role in urban growth. Migration, in turn, is responsive to economic motives and often works under the combined influence of "push" and "pull" forces. Population pressure in the Punjab's "congested" agricultural areas and, in recent years, some degree of mechanization of agriculture owing to Pakistan's "Green Revolution" plus a general lack of modern amenities have compelled people to move out of villages and some small towns; while urban areas with their increasing employment opportunities have exerted a "pull" on these migrants. This is supported by the fact that the Punjab's four largest urban settlements : Lahore, Lyallpur, Rawalpindi and Multan, with one fourth of the nation's urban or only six per cent of its total population, contain one third of the country's industrial labour force. (116) An analysis of the 1972 data of the Punjab's districts revealed a moderately high correlation (r = +0.617) between the rate of in-migration and the sex ratio (M/F) of the urban populations; and a relatively low correlation (+0.423) between the former and the sex ratio of the rural populations. The difference in the two values points out the direction and sex-selectivity of migration.

An interesting aspect of urbanization in the region is that, generally speaking, the largest urban centres are those with important administrative functions such as tehsil, district or divisional headquarter towns which exercise a sort of "primacy" on the towns of their respective units. Of the Punjab's five divisions, for instance, four divisional cities are the largest in their respective divisions, the only exception is Sargodha division where Lyallpur outranks the divisional headquarter town. At the district level, the only exception to this rule is Muzaffargarh, where Leiah is the district's principal town. Similarly, in 58 of the 73 tehsils, the tehsil towns are the largest in their respective tehsils. This uneven distribution of urban population, in turn, has a great bearing on the differential population growth.

3.7.4. Patterns of Rural Population Growth

As can be seen from Table 3.24, the Punjab's rural population has evolved at a much slower rate than its urban counterpart. Nonetheless, this was the sector where larger numerical change took place. Between 1901 and 1972, the Punjab increased its rural population by 203.2 per cent which meant a numerical addition of 19,052,553 or more than twice that of the urban. As discussed in Section 3.2, throughout the post-1881 period the rural population increase, stimulated by the expansion of irrigation and the resultant widening of the food base, played a major role in the region's total population growth. This was indicative of in-migration to the rural areas but also, in the post-1921 period, of a moderately accelerating natural growth. Rural-urban migration in the wake of rising urbanization notwithstanding, population in the rural areas continued to climb steadily. Like the urban localities, rural sector also gained through in-migration during the period 1941-51, when due to Partition a major reshuffle of population took place and muhajirs preferred to settle in the agriculturally prosperous areas.

Between 1901 and 1951, the Province's rural population rose by 82 per cent, underlain by marked regional contrasts (Fig. 3.20(a)). The highest increases were experienced by Sahiwal (298.5 per cent), Lyallpur (228.1) and Multan (198.6) followed by the Bahawalpur division. The Sahiwal-Lyallpur-Multan triangle experienced an overall increase of 235.6 per cent, while Bahawalpur division's was 140.3 per cent.

Between 1951 and 1972, the Province as a whole increased its rural population by 66.6 per cent when the highest district increase rates were experienced by Muzaffargarh (107.4 per cent), Rahimyar Khan (95.0) and Bahawalpur (93.1) which together experienced a rise of 99.4 per cent (Fig. 3.20(b)). The association of these increases with the expansion of irrigation is only too obvious. The Province's rural population lived in its 22,034 villages in 1951, 23,672 in 1961 and 24,700 in 1972. The average village population in the three years was 774,886 and 1,151 respectively. Thus, whereas the Province's overall

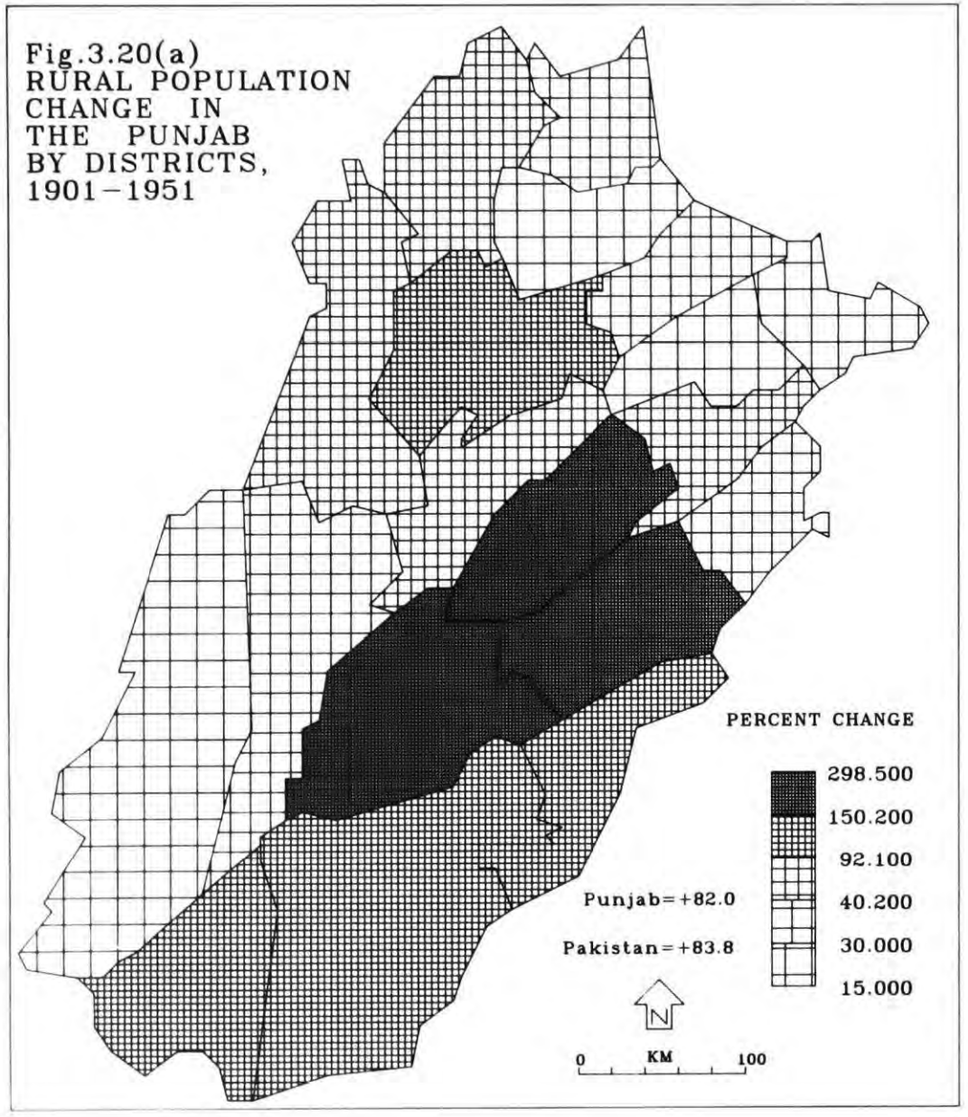


Fig.3.20(a)
RURAL POPULATION
CHANGE IN
THE PUNJAB
BY DISTRICTS,
1901-1951
PERCENT CHANGE
298.500
150.200
92.100
40.200
30.000
15.000
Punjab=+82.0
Pakistan=+83.8
N
0 KM 100

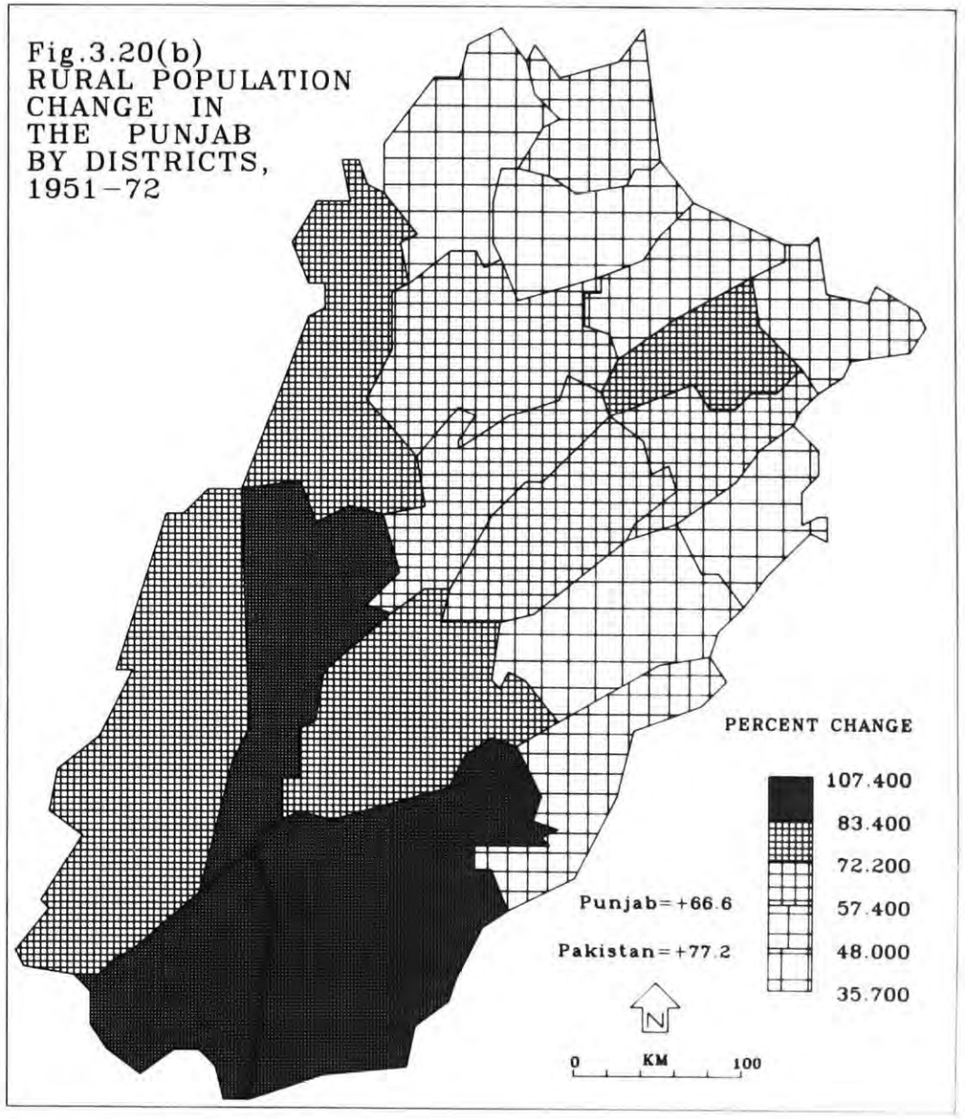


Fig.3.20(b)
RURAL POPULATION
CHANGE IN
THE PUNJAB
BY DISTRICTS,
1951-72
PERCENT CHANGE
107.400
83.400
72.200
57.400
48.000
35.700
Punjab=+66.6
Pakistan=+77.2
N
0 KM 100

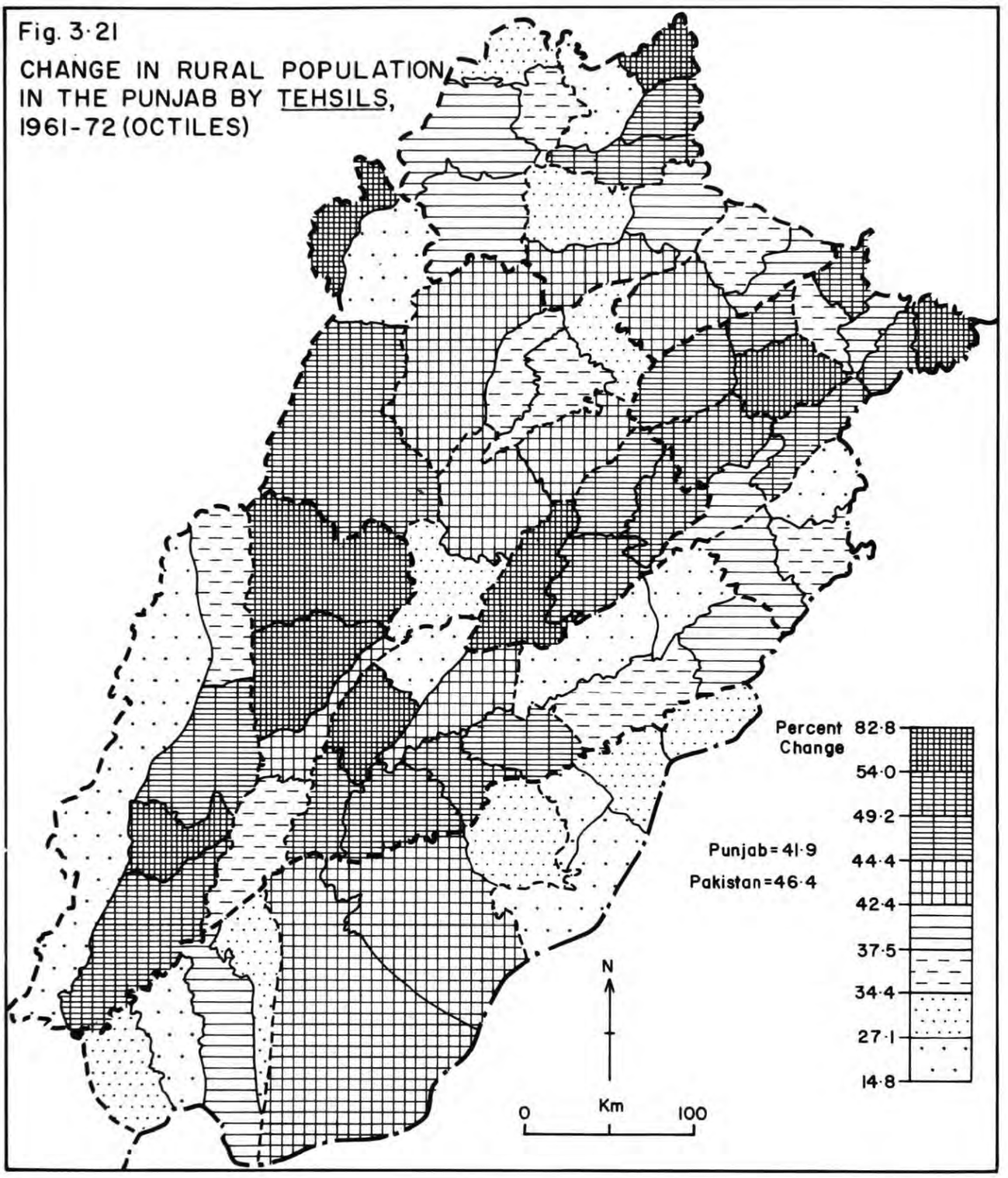


Fig. 3·21
CHANGE IN RURAL POPULATION IN THE PUNJAB BY TEHSILS, 1961-72 (OCTILES)
Percent Change
82·8
54·0
49·2
44·4
42·4
37·5
34·4
27·1
14·8
Punjab = 41·9
Pakistan = 46·4
N
0
Km
100

rural population rose by 17.4 and 41.9 per cent during the periods 1951-61 and 1961-72 respectively, the average village population increased by 9.3 and 36.1 per cent.

A vivid picture of the regional contrasts of rural population growth is presented by Figure 3.21 in which the rural population change for the period 1961-72 is depicted by tehsils. The Punjab's rural population during this period increased from 20,026,996 to 28,427,464 or by 41.9 per cent. This rate of change was exceeded by 37 tehsils some of which showed conspicuously high rates : Leiah 82.8 per cent), Kot Addu (71.2), Murree (63.4), Isakhel (61.6), Gujranwala (60.0), Multan (58.9), Shakargarh (55.7), Tobatek Singh (55.4) and Jampur (55.2). Together these nine tehsils experienced a rise of 61.2 per cent, which was associated with the exploitation of agricultural potential and the resultant in-migration. Ten tehsils at the other end of the scale with lowest intercensal increases in their rural populations were : Kabirwala (27.1 per cent), Mianwali (26.2), Chishtian (26.0), Lahore (25.9), Rahimyar Khan (25.1), Baluch Tract (24.7), Sahiwal (24.2), Okara (21.8), Fort Abbas (21.1) and Rawalpindi (14.8), which together experienced an increase of only 23.7 per cent, appreciably less than the level of natural increase. This points out the force of out-migration to the urban as well as to other relatively more promising rural areas. This is particularly true of the old canal colony areas which lost a considerable portion of their rural population to the newly irrigated and reclaimed tracts. In the process, Sahiwal, Okara, Rahimyar Khan and Fort Abbas, to cite a few examples, lost sizeable rural populations to Leiah, Kot Addu and Jampur. Isakhel's spectacular increase and the corresponding slackening of the rate of rural population growth in its southern neighbour,Mianwali, is also explicable in terms of such rural to rural transfers. In some irrigated areas the hazard of water-logging and salinity also caused population out-flow. However, in the absence of the relevant data at tehsil level, this point can not be demonstrated on a quantitative basis.

It can now be summarized that the spatial variation of rural population

TABLE 3.26 MESO-SCALE REGIONAL VARIATIONS IN THE RATES OF TOTAL, URBAN AND RURAL POPULATION GROWTH IN THE PUNJAB, 1951-72

Type *	Number of Districts	Total Population 1951		1972		Change 1951 - 1972	
		No.	% of Punjab	No.	% of Punjab	No.	%
AAA	4	5,475,610	26.5	10,743,752	28.6	5,268,142	96.2
AAB	1	908,327	4.4	1,747,685	4.6	839,358	92.4
ABA	3	2,326,224	11.2	4,695,676	12.5	2,369,452	101.9
ABB	1	1,895,228	9.2	3,774,007	10.0	1,878,779	99.1
BAA	1	923,360	4.5	1,657,149	4.4	733,789	79.5
BAB	1	630,538	3.1	1,073,891	2.9	443,353	70.3
BBA	3	2,670,443	12.9	4,804,409	12.8	2,133,966	79.9
BBB	5	5,821,410	28.2	9,113,590	24.2	3,292,180	56.6
PUNJAB	19	20,651,140	100.0	37,610,159	100.0	16,959,019	82.1

* For definitions see the text

TABLE 3.26 (Cont.)

Type	No. of Dist-ricts	Urban Population								Rural Population					
		1951			1972			Change 1951-72		1951		1972		Change 1951-72	
		No.	% of Pun-jab	% of Tot-al	No.	% of Pun-jab	% of Tot-al	No.	%	No.	% of Pun-jab	No.	% of Pun-jab	No.	%
AAA	4	734,374	20.5	13.4	2,376,874	25.9	22.1	1,642,500	223.7	4,741,236	27.8	8,366,878	29.4	3,625,642	76.5
AAB	1	287,951	8.0	31.7	771,602	8.4	44.2	483,651	168.0	620,376	3.6	976,083	3.4	355,707	57.3
ABA	3	389,476	10.9	16.7	935,346	10.2	19.9	545,870	140.2	1,936,748	11.3	3,760,330	13.2	1,823,582	94.2
ABB	1	980,821	27.3	51.8	2,421,507	26.4	64.2	1,440,686	146.9	914,407	5.4	1,352,500	4.9	438,093	47.9
BAA	1	82,617	2.3	9.0	245,883	2.7	14.8	163,266	197.6	840,743	4.9	1,411,266	5.0	570,523	67.9
BAB	1	50,644	1.4	8.0	164,337	1.8	15.3	113,693	224.5	579,894	3.4	909,554	3.2	329,660	56.8
BBA	3	423,922	11.8	15.9	925,297	10.1	19.3	501,375	118.3	2,246,521	13.2	3,879,112	13.6	1,632,591	72.7
BBB	5	637,125	17.8	10.9	1,341,849	14.5	14.7	704,724	110.6	5,184,285	30.4	7,771,741	27.3	2,587,456	49.9
PUN-JAB	19	3,586,930	100.0	17.4	9,182,695	100.0	24.4	5,595,765	156.0	17,064,210	100.0	28,427,464	100.0	11,363,254	66.6

SOURCE : Computed by the author

growth in the region has been a function of natural increase,which is thought to be higher than in urban areas, and the migration in and out flows. The level and trend of agricultural expansion has been an overriding factor in deciding the direction of rural to rural flow of population. The newly opened areas have, throughout the period of canal irrigation development, lured people from other parts of the Province and always offered great incentives to the farming class, ever-eager to expand the size of their holdings and ever-confident, on the basis of their previous experience, to embark upon the task of reclaiming desert waste in the newly irrigated tracts. The development of roads in these areas was an additional advantage, which not only reduced the isolation of the rural areas but also provided them a ready access to the neighbouring, usually small or medium sized, towns which served the dual purpose of markets and the agricultural input suppliers. On the other hand, the areas with soaring land values and small fragmented holdings in the central doab districts as well as those suffering from waterlogging and salinity, discouraged the population to stay.

3.8. TYPOLOGY OF POPULATION CHANGE

In order to sum up the urban-rural differential and thus to have a clearer and more compact picture of the Province's population growth, a mosaic of the different types of population change since Independence is put together by employing a typology as worked out by Dewdney (1971). (117)

The average rates which form the basis of comparison in this typology, are those of the Punjab as a whole. The rates of increase of total, urban and rural population in each constituent areal unit of the Province are compared with the respective Provincial rates. As a result, eight types of population growth emerge. The experiment was conducted at two levels : the "meso" level for districts and the "micro" level for tehsils and the results of the computations are set out in Tables 3.26 and 3.27 and plotted in Figures 3.22 and 3.23.(118)

TABLE 3.27 MICRO-SCALE REGIONAL VARIATIONS IN THE RATES OF TOTAL, URBAN AND RURAL POPULATION GROWTH IN THE PUNJAB, 1951-72

Type*	Number of Tehsils	Total Population 1951		1972		Change 1951 - 1972	
		No.	% of Punjab	No.	% of Punjab	No.	%
AAA	10	3,376,595	16.4	7,398,148	19.7	4,021,553	119.1
AAB	3	912,515	4.4	1,793,769	4.7	881,254	96.6
ABA	10	1,783,677	8.6	3,657,543	9.7	1,873,866	105.1
ABB	1	1,134,900	5.5	2,587,621	6.9	1,452,721	128.0
BAA	2	636,058	3.1	1,118,744	3.0	482,686	75.9
BAB	14	3,739,864	18.1	6,039,880	16.1	2,300,016	61.5
BBA	13	3,572,217	17.3	6,234,242	16.6	2,662,025	74.5
BBB	20	5,495,314	26.6	8,780,212	23.3	3,284,898	59.8
PUNJAB	73	20,651,140	100.0	37,610,159	100.0	16,959,019	82.1

* For definitions see the text

TABLE 3.27 (Cont.)

Type	No. of Tehsils	Urban Population								Rural Population					
		1951			1972			Change 1951-72		1951		1972		Change 1951-72	
		No.	% of Punjab	% of Total	No.	% of Punjab	% of Total	No.	%	No.	% of Punjab	No.	% of Punjab	No.	%
AAA	10	707,878	19.7	21.0	2,391,821	26.1	32.3	1,683,943	237.9	2,668,717	15.6	5,006,327	17.6	2,337,610	87.6
AAB	3	305,174	8.5	33.4	927,363	10.1	51.7	622,189	203.9	607,338	3.6	866,406	3.0	259,068	42.7
ABA	10	223,822	6.2	12.5	454,097	4.9	12.4	230,275	102.9	1,559,855	9.1	3,203,446	11.3	1,643,591	105.4
ABB	1	859,364	24.0	75.7	2,198,890	23.9	85.0	1,339,526	155.9	275,536	1.6	388,731	1.4	113,195	41.1
BAA	2	32,337	0.9	5.1	105,680	1.2	9.5	73,343	226.8	603,721	3.5	1,013,064	3.6	409,343	67.8
BAB	14	229,048	6.4	6.1	774,997	8.4	12.8	545,949	238.4	3,510,816	20.6	5,264,883	18.5	1,754,067	50.0
BBA	13	556,539	15.5	15.6	943,063	10.3	15.1	386,524	69.5	3,015,679	17.7	5,291,179	18.6	2,275,500	75.5
BBB	20	672,768	18.8	12.2	1,386,784	15.1	15.8	714,016	106.1	4,822,548	28.3	7,393,428	26.0	2,570,880	53.3
PUNJAB	73	3,586,930	100.0	17.4	9,182,695	100.0	24.4	5,595,765	156.0	17,064,210	100.0	28,427,464	100.0	11,363,254	66.6

SOURCES: Computed by the author

Fig 3·22

TYPES OF POPULATION CHANGE IN THE PUNJAB'S DISTRICTS, 1951–1972

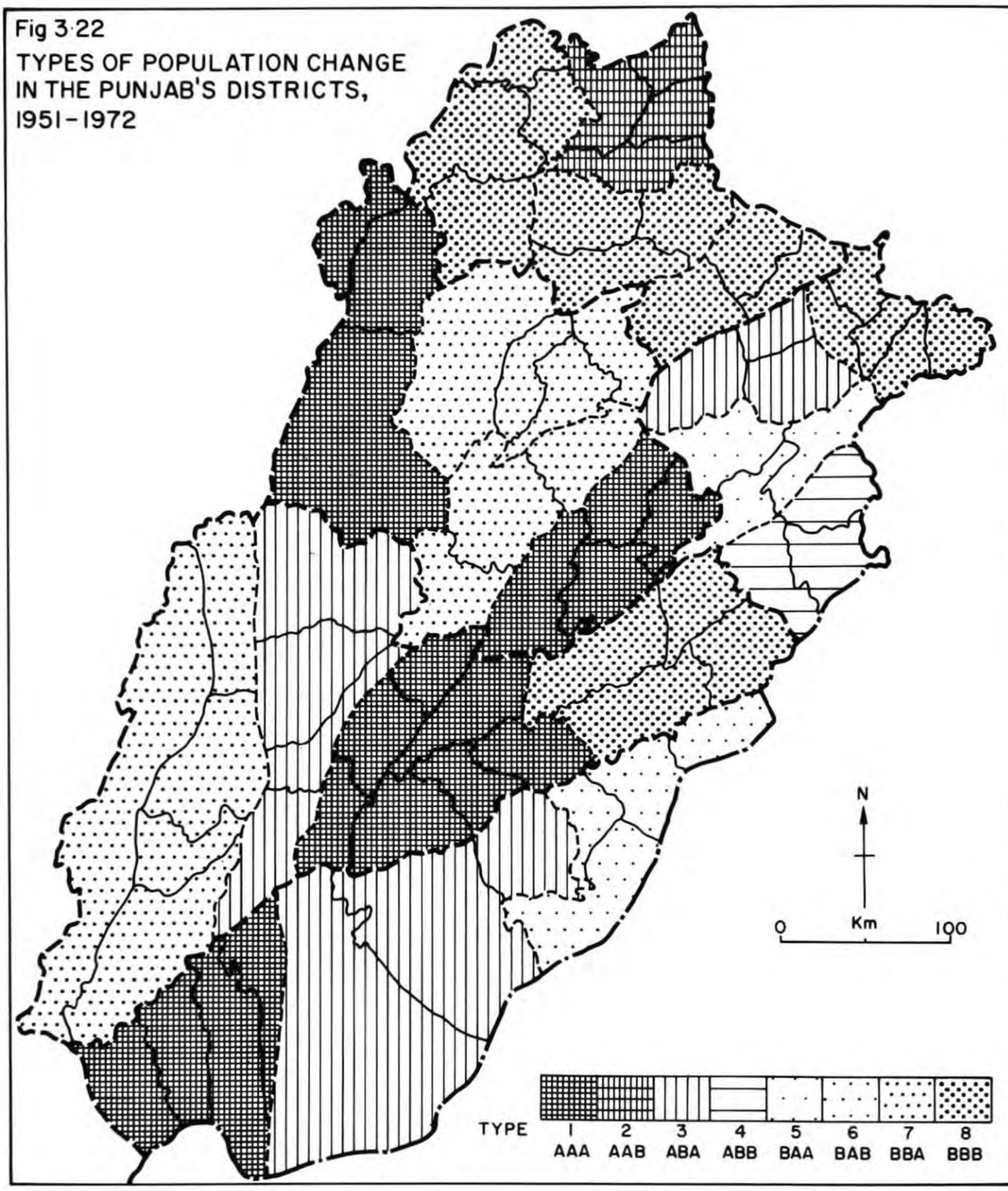
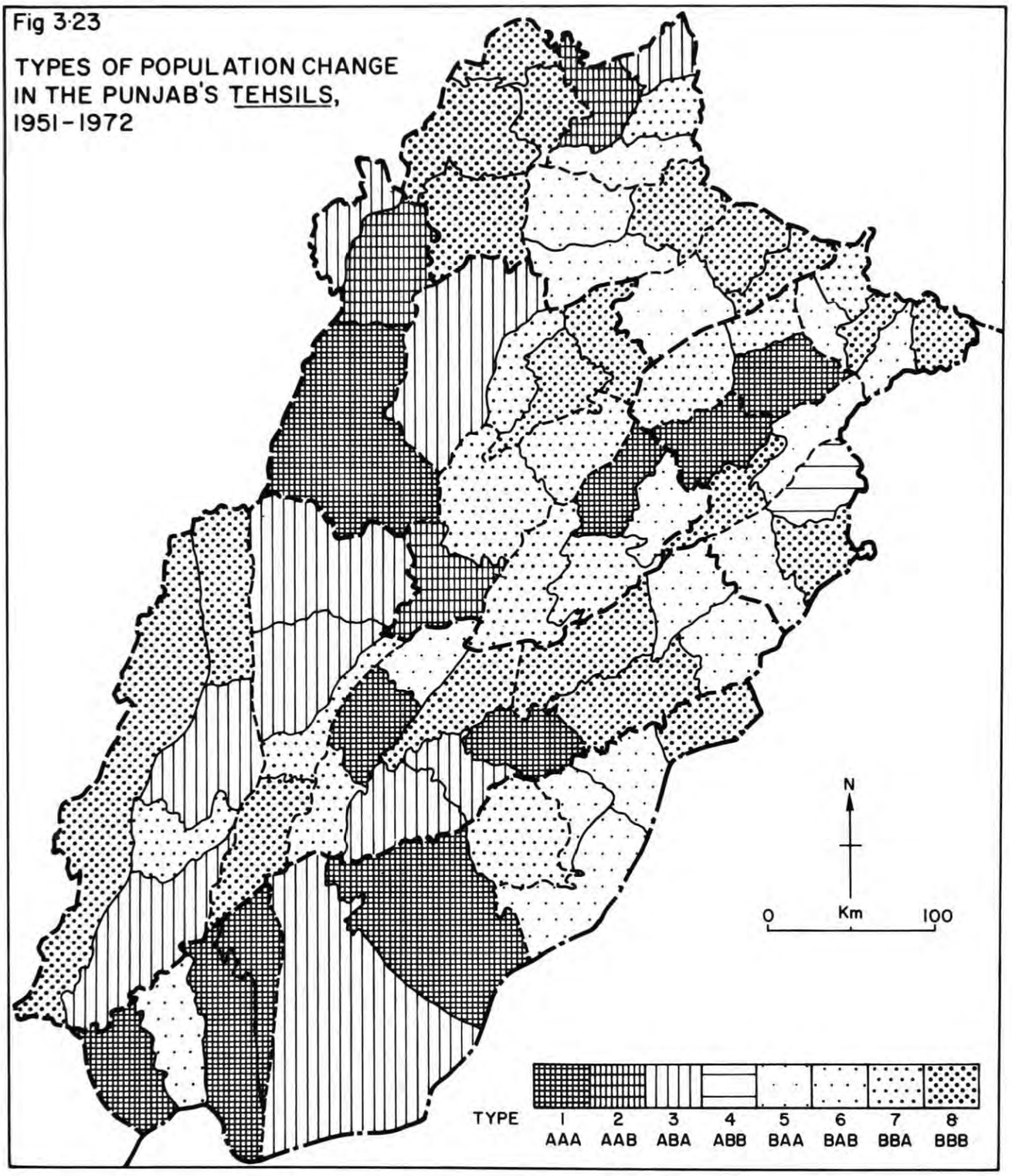


Fig 3·23

TYPES OF POPULATION CHANGE IN THE PUNJAB'S TEHSILS, 1951-1972



The two extreme types of the micro-scale typology are selected here to recapitulate what has been substantiated earlier regarding the regional contrasts in the Province's population growth.

TYPE 1 (AAA) : From 1951 to 1972, the ten tehsils in this category experienced a total increase of over 4 million (119.1 per cent) which, in numerical terms, makes up for almost a quarter of the overall Provincial change. Population in both urban and rural sectors increased sharply - by 237.9 and 87.6 per cent respectively. The highest rates of growth were recorded in Khanpur (200.1 per cent), Lyallpur (142.9), Bahawalpur (134.4), Multan (120.1), Gujranwala (115.4), Bhakkar (113.5), Liaqatpur (111.0) and Sadiqabad (103.2). Spread throughout the Province, these tehsils witnessed a phenomenal change in their economy through the expansion of agriculture and industries. Emergence and growth of mandi (market) towns accelerated the pace of urbanization; and the level of urban population rose from 21.0 in 1951 to 32.3 per cent in 1972. The in-migration reflected by the rapid urbanization in combination with a high natural increase of the region, produced an exceptionally high rate of population change in these tehsils, which is characterized by their rising share of the Province's population. From 1951 to 1972, their share of the Punjab's total population increased from 16.4 to 19.7 per cent, that of urban population from 19.7 to 26.1 and rural population from 15.6 to 17.6 per cent.

TYPE 8 (BBB) : This type encompassed 20 tehsils where all the three rates were below the Provincial average. Although their total increase was over 3 million (59.8 per cent) or almost one fifth of the Province's, their share of the Provincial total, urban and rural populations declined during the period 1951-72 from 26.6 to 23.3, 18.8 to 15.1 and 28.3 to 26.0 per cent respectively. Their level of urbanization, however, improved by a nominal 3.6 percentage points compared with 7 points of the Province as a whole. Although some of these tehsils such as Sargodha, Bhalwal, Khanewal, Sahiwal and Pakpattan contain a high class agricultural area, they did not experience a good degree of agricultural production, particularly during the period 1951-61 owing to a countrywide

stagnation of agriculture (Section 5.6). As a result, their rural populations received a set-back through out-migration. Furthermore, due to their remoteness from the main rail and road networks or their unfavourable location with respect to labour and market, they failed to attract industries. Consequently, with slackened trade and commerce, these tehsils lost some of their economic potential to other relatively flourishing tehsils. However, with the resuscitation of agriculture during the 1961-72 period and decentralization of industries in the wake of inducements offered by the government, some of these tehsils such as Gujrat, Sargodha, Bhalwal, Kasur, Pasrur, Shakargarh and Khanewal recaptured their economic potential which not only checked their out-migration but also encouraged, in some cases, the reversal of that phenomenon. As a result, the population growth rates in these tehsils resurged between 1961 and 1972. Nonetheless, combined with the low rates of the earlier decade the overall 1951 - 72 rates remained one of the lowest.

3.9. SUMMARY AND CONCLUSION

In this chapter, the region's population evolution has been analyzed in detail. Before embarking upon a discussion of the Punjab's population change in the twentieth century, a detailed survey of the subject was conducted for the earlier periods, mainly in the wider context of the subcontinent.

The subcontinent has been one of the world's most populous regions since time immemorial. The Punjab, in turn, being the main centre of the Indus Valley Civilization, enjoyed the principal position in terms of economic prosperity and population concentration among the country's regions and contained, during the heyday of the Civilization almost four fifths of the subcontinent's population. But it lost that position in the subsequent centuries possibly due to Aryan inroads. However, there is ample evidence in history to suggest that the region experienced marked crests and troughs in its population growth during various historical periods. The population is believed to have attained a substantial size during the periods of stable rule characterized by material progress,

socio-cultural prosperity and organized administration, for example under Chandragupta Maurya (c.322-298 BC), Asoka (c.269-232 BC), Chandragupta II (c.385-413), Harsha (606-647),and Akbar (1556-1605) and his immediate successors. Although precise statistical information about these early periods is not available, the overall population growth for almost 2000 years before the British rule is believed to have been very small.

The commencement of British rule marks a watershed in the region's economic as well as its demographic history. Not only did the region's economy experience a turning point but an era of systematic census-taking also dawned. Shortly before the British annexed the Punjab, the Province was the scene of tumultuous disorder. Once law and order were established,a speedy resuscitation of economic life took place. However, the greatest challenge to human life now was presented not by plunder and rapine but by widespread disease and hunger. The available records reveal that numerous calamitous famines and epidemics coming in successive waves claimed millions of lives. The effects of these calamities became acute since the lack of communications would not permit quick and efficient contact with the areas hit by disease and hunger. During the last quarter of the nineteenth century, however, signs of improvement began to emerge. The development of canal irrigation not only broadened the food base via agricultural expansion but also gave new dimensions to the region's economy. In addition, speedy development of road and rail networks reduced the isolation of various parts of the region and provided the basis for a quick distribution of food. Epidemics were arrested by remarkable improvements in sanitation and health facilities.

The year 1921 marks a demographic divide in the region's population evolution. The reforms introduced in irrigation, agriculture, industry, commerce, transport, hygiene and sanitation started to be tangibly reflected in the region's declining mortality and in its ultimate rising natural increase. Thus, after 1921 the region's population assumed a sharper growth trend. The regional variations of population change in the Punjab were, however, in addition to the

rising natural increase, the outcome of population redistribution associated with the expansion of canal irrigation. It is interesting to note that, although all regions showed signs of increase, canal irrigated areas increased their populations more rapidly. This trend continued after Independence.

In 1947, accompanying Independence and the Punjab's partition, an unprecedented reshuffle of population took place. The districts with large net in-migration increased their populations at an exceptionally high rate. Also associated with Partition was large scale loss of life by massacre, which temporarily depressed the natural growth of population. However, the trend towards lower mortality which marks the post-1921 period, together with a continuing high fertility, were characteristic of the post-Independence decades.

Between 1951 and 1972, the Punjab's population rose by 82.1 per cent, which meant a numerical addition of some 17 million or a compound growth rate of 2.8 per cent. This was more than double the average rate of 1.4 per cent recorded during the first half of the twentieth century. As a result, the Province's population size had grown more than 3½ times between 1901 and 1972. The increase from 1961 to 1972 was exceptionally high - 47.6 per cent or more than twice that experienced during the first post-Independence intercensal period. This high rate was the outcome of a near-constant fertility and a continuously and sharply declining mortality reflected by the Province's steady socioeconomic progress. Birth rate in the Punjab declined from 47.5 per thousand during the 1951-60 period to 46 in the following decade; whereas death rate slumped from 20 to 12.5 per thousand during the same length of time. Future estimates of population are fraught with uncertainty because of unpredictable behaviour of birth and death rates. However, if the present trends of these components remain without an appreciable change, the Province's population size would reach about 85 million or even more by the end of the twentieth century, marking a more than eight-fold increase since the dawn of the century.

With three fourths of the people living in the countryside, there exists

a strong urban-rural differential in the region's population growth. Despite its rural economy, however, the Province is sharply increasing the number of its urban-dwellers through rural-urban and town-city migration, linked with a phenomenal transformation of its economy. This is reflected by the steadily climbing level of urbanization. The pace of urbanization has been particularly faster after Independence, when the Province's level of urbanization rose from 17.4 per cent in 1951 to 24.4 in 1972, marking an increase of almost six million or 156 per cent, which was in sharp contrast to an increase of 66.6 per cent in the Province's rural population.

There have been marked regional contrasts in the total, urban and rural population change in the Punjab. These were discussed at length separately as well as in a combined form by evolving a typology of population change. According to the model used, ten tehsils with 19.7 per cent of the total, 26.1 per cent of the urban and 17.6 per cent of the rural population of the Punjab in 1972, experienced higher rates of growth in all three forms between 1951 and 1972, than did the Province as a whole.

Marked regional contrasts in the Punjab's population evolution have given rise to spatial patterns of population distribution, which are discussed in the next chapter.

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118. Rates of population change in total (T), urban (U) and rural (R) populations experienced by various constituent areal units are correspondingly compared with those of the Province as a whole, for the period 1951-72. Letter 'A' stands for 'above' and 'B' for 'below'. Thus the type AAA denotes that all three rates are above the three corresponding Provincial rates; in ABA type, the rates of total and rural populations are above and that of urban below the Province's rate; and BBB indicates all three rates below the Provincial rates.

CHAPTER IV

DISTRIBUTION OF POPULATION

4.1. INTRODUCTION

In the preceding chapter, the evolution of population in the Punjab was analyzed in detail. Although the major emphasis in terms of time period was on the post-Independence intercensal periods 1951-61 and 1961-72, the investigation was extended back to the beginning of the twentieth century. The evolutionary trends were also traced further back in the wider context of the subcontinent and that of British Punjab. Similarly, although the major concern was to study the spatial patterns of population growth in the Punjab, frequent references were made, for the sake of comparison, to the phenomena of population change in Pakistan as a whole.

As has been seen, the Punjab's population almost quadrupled between 1901 and 1972. As a result, the density of population mounted from 50 per sq.km. in 1901 to 101 in 1951 and 183 in 1972. As a result of the massive redistribution of population, stimulated mainly by agricultural expansion via irrigation development as well as by fast urbanization, there are pronounced regional variations in the population distribution. These are the subject of discussion in the present chapter.

4.2. DISTRIBUTION OF POPULATION IN PAKISTAN

4.2.1. World Comparisons

Pakistan is a country with both a large population and a high population density. Occupying 0.6 per cent of the world's area or 2.9 per cent that of Asia, it contains 1.8 per cent of the world's and 3.2 per cent of Asia's population. According to the 1978 population estimates, the country's population was 77.7 million. [1] While 31 countries in the world surpass Pakistan in area, only eight have a larger population size. The sixth most populous country in Asia, Pakistan is also the sixth most populous in the

Third World and ranks third amongst the Muslim countries after Indonesia and Bangladesh. Although its population size is less than one eighth that of its eastern neighbour, India; it contains more than twice as many people as its western neighbour, Iran; more than four times that of Afghanistan; and more than any European country excluding the USSR.

However, these comparisons, although seemingly impressive, are shallow since they bear little relevance to the country's economic status amongst the comity of nations. Pakistan's per capita GNP is the lowest, with the exception of Bangladesh and India, amongst the world's fifteen most populous countries, let alone the oil rich and industrially advanced nations (Table 4.1).

Computed on the basis of the 1978 population estimate, Pakistan's population density is 98 per sq. km. This places it, as does population size, in an intermediate position between its more densely settled eastern neighbour, India (201 per sq. km.) and the sparsely populated western neighbours, Iran (22) and Afghanistan (27). Excluding small island and city states, which have an intrinsic tendency towards high population densities, Pakistan's density is exceeded by 27 countries of the world. Most of these, however, either have very small territories like Burundi and El Salvador with small total populations as well or they are highly urbanized and industrialized like Japan and most European countries.

For the sake of correctness, the country's population density should not be compared with that of much smaller areas. A more meaningful comparison can be made by collating the densities of countries having more or less similar population or areal sizes. Table 4.1 shows selected economic-geodemographic characteristics of the world's 15 most populous countries. It is clear that Pakistan's population density ranks seventh amongst these countries. It must be noted, however, that four out of the six countries exceeding Pakistan in population density are the highly

TABLE 4.1 SOME ECONOMIC-GEODEMOGRAPHIC CHARACTERISTICS OF THE WORLD'S FIFTEEN MOST POPULOUS COUNTRIES, 1978

Country	Population millions	Rank	Pop. Density Per km^2 (1)	Rank	Rural Pop. %	Cultiv-able Area %(2)	Agri. Pop. %(3)	Per cap. GNP US$	CBR (4)	CDR (4)
China	880.2	1	92	9	76	11.5	61.4	410	22	8
India	661.0	2	201	5	79	57.0	64.4	150	34	14
USSR	261.2	3	12	15	38	10.4	18.1	2,760	18	9
USA	218.3	4	23	13	26	20.6	2.4	7,890	15	9
Indonesia	147.1	5	77	10	82	9.5	60.4	240	38	14
Brazil	119.5	6	14	14	40	4.8	39.7	1,140	36	8
Japan	114.9	7	309	2	24	13.4	12.5	4,910	16	6
Bangladesh	79.9	8	555	1	91	68.1	84.4	110	47	20
PAKISTAN	77.7	9	98	7	74	26.1	54.5	170	44	14
Nigeria	68.7	10	74	11	82	26.3	55.1	380	49	21
Mexico	65.4	11	33	12	36	12.1	37.8	1,090	42	8
F.R.Germany	61.3	12	247	3	8	32.8	4.6	7,380	10	12
Italy	56.7	13	188	6	47	41.5	12.5	3,050	14	10
United Kingdom	56.0	14	229	4	24	28.9	2.2	4,020	12	12
France	53.3	15	97	8	30	34.5	9.5	6,550	14	10
Asia (Ex.USSR)	2399.4	-	87	-	74	17.1	59.2	610	30	12
World	4182.4	-	31	-	61	11.2	50.9	1,650	29	12

(1) Densities calculated against 1975 areas. UN Demographic Yearbook 1975.
(2) Arable Area plus Area under permanent crops % of land area.
(3) % of Economically Active Population in Agriculture
(4) Annual number of births or deaths per 1,000 population

SOURCES : 1. FAO Production Yearbook 1978

2. 1978 World Population Data Sheet

industrialized and urbanized West European nations and Japan. The other two are Bangladesh and India. It is interesting to note that, while China's population is more than eleven times that of Pakistan, its overall population density is less than Pakistan's. France, on the other hand, with 38 times larger per capita GNP has a population density equal to that of Pakistan.

4.2.2. Diversity Amongst Provinces

Fairly reliable population data for Pakistan are available from its series of population censuses. According to the last census held in the latter half of September, 1972, the country's total population was 65,309,340 indicating an intercensal increase of 22,403,769 or 52.2 per cent between 1961 and 1972. (2) Arithmetic density rose from 54 to 82 per sq. km. over the same period. However, these average density figures are misleading. With about three quarters of its people living in villages and 56.2 per cent of its workforce directly engaged in agriculture (3) Pakistan has a predominantly agro-rural economy. Thus a nutritional density, giving the number of persons per sq. km. of agricultural land,would be a better index of the spread of population. Agricultural area in Pakistan is classified into cultivated area (which includes current fallow and the net sown area) and total cropped area (which consists of the net sown and the double cropped area). As the current fallow and the double cropped areas suffer from wide fluctuations, the net sown area provides a relatively more convenient and consistent basis for calculating nutritional density. Pakistan's total net sown area between 1970-1 and 1974-5 was 143,000 sq.km., or 18 per cent of the land area. (4) A nutritional density computed against this area is 455 per sq. km., which is indicative of a heavy population pressure on land resources and the resulting low standard of living.

Average density of population is also misleading since it conceals a considerable variation at the provincial level. The Punjab, the most densely populated province, for example, has an average density of 183 per sq.km.

which is more than 26 times that of the sparsely peopled Baluchistan. In rural population density the ratio is a little narrower, 23:1. The contrasts in other types of density are equally pronounced but the resultant picture varies according to the denominator used in the calculation of density. While the Punjab has an arithmetic density and a rural density many times that of Baluchistan, the latter has a density per sq. km. of cropped land almost twice that of the Punjab (Table 4.2).

At the district level such contrasts are more striking. While Karachi district in Sind Province has an average density of 1022 per sq.km. and Lahore in the Punjab 654; Kalat and Kharan districts in Baluchistan have less than 2 per sq.km. Similarly, while no district in Baluchistan has an average density exceeding 36 per sq.km., the lowest district density in the Punjab, that of Bahawalpur, is 43. Such contrasts indicate the enormous variations in land use and overall economic conditions.

4.3. DISTRIBUTION OF POPULATION IN THE PUNJAB

4.3.1. General Considerations

As Table 4.2 indicates, the Punjab is the most populous province of Pakistan, both in terms of the absolute numbers and arithmetic density. With 57.6 per cent of Pakistan's total population, the Province has an overall density of 183 per sq.km. - more than double the average for the country as a whole and almost twice that of the next most populous province, Sind.

According to the 1972 Census, the Punjab's total population was 37,610,159 - an increase of 12,122,630 or 47.6 per cent over that recorded 11 years 8 months earlier in 1961. Although the Province's share of the total national population declined from 59.4 to 57.6 per cent during the period 1961-72, its arithmetic density increased from 124 to 183 per sq.km.

Assuming that the Punjab's share of Pakistan's total population remained constant as in 1972, the size of the Province's population can be calculated

TABLE 4.2

POPULATION DISTRIBUTION AND DENSITY IN PAKISTAN BY PROVINCES AND REGIONS, 1972

Territory	Area		Population		Urban	Density Per sq.km.		Nutritional Density Net Sown Area		Nutritional Density T. Cropped Area	
	000 sq.km	% of Pak.	000	% of Pak.	%	Tot. Pop.	Rur. Pop.	Tot. Pop.	Rur. Pop.	Tot. Pop.	Rur. Pop.
PUNJAB	205.3	25.8	37,610	57.6	24.4	183	138	379	287	333	252
Sind	140.9	17.7	14,156	21.7	40.5	100	60	528	315	436	260
NWF	74.5	9.4	8,388	12.8	14.3	113	97	624	535	507	435
Baluchistan	347.2	43.6	2,429	3.7	16.5	7	6	612	512	588	492
FCTI*	0.9	0.1	235	0.4	32.6	259	175	(x)	(x)	(x)	(x)
FATA*	27.2	3.4	2,491	3.8	0.5	92	91	(x)	(x)	(x)	(x)
PAKISTAN	796.0	100.0	65,309	100.0	25.4	82	61	455	340	393	293

* FCTI (Federal Capital Territory Islamabad) and FATA (Federally Administered Tribal Areas) are not provinces but administrative units under the Federal Government's control.

(x) Not Available

SOURCES: computed from :

1. District Census Reports 1972 (52 volumes)
2. Agricultural Statistics of Pakistan 1975.

from the 1978 population estimate of Pakistan as 44.8 million and the corresponding arithmetic density as 218 per sq.km. Thus the Punjab is comparable in population size to Turkey (43.0 million), the Philippines (46.4) and Thailand (46.4), but its density is much higher than that of those three countries (Table 4.3).

Three quarters of the Punjab's population is classed as rural and 55.1 per cent of its labour force was employed in agriculture in 1973. (5) The Province's net sown area during the period 1970-1/1974-5 was 99,370 sq. km. or 48.4 per cent of the total. (6) The rural density based on rural population and total area was 138 per sq.km., again more than double the national average; and the Province's nutritional density per sq.km. of the net sown area according to the 1972 statistics was 379 against 455 of Pakistan as a whole and 528 of the next most populous and agriculturally important province, Sind.

The diversity of population distribution can be explained in terms of a complex of factors : physical, economic, demographic, cultural and political. It is, in fact, an interplay of these variables which tends to influence the population distribution and results in its uneven character; and it is virtually impossible to interpret the areal patterning of population distribution in terms of any single influence. However, in the Punjab, where agriculture is the principal economic activity and the mainstay of the Province's economy, the pattern of population distribution is closely associated with the exploitation of agricultural resources and population density reflects the location and productivity of cultivable land. Agricultural performance is, in turn, influenced by such diverse factors as landform, soil, climate, water availability, cultivable area, cropping patterns, farming techniques, size of holdings and, to some extent, government policies.

Of all these factors, the availability of water is of a vital and

TABLE 4.3

SELECTED ECONOMIC-GEODEMOGRAPHIC CHARACTERISTICS OF THE PUNJAB AND COUNTRIES WITH COMPARABLE POPULATION SIZE, 1978

Area	Population Millions	Population density Per.sq.km	Rur.Population %	Cultivable Area %	Agri.Pop. %	Per.Cap.GNP US$
PUNJAB	44.8	218	76	54.1	57.3	-
Turkey	43.1	55	55	36.2	57.2	990
Philippines	46.4	155	68	27.2	47.5	410
Thailand	46.4	90	87	34.5	76.3	380

(-) Not Available

SOURCES: 1. As in Tables 4.1 & 4.2

2. Development Statistics of the Punjab 1976

3. Punjab Development Review and Prospects

fundamental importance. This is so because, excepting a narrow submontane belt in the north, the whole Province is arid or semi-arid. Since rainfall is erratic and too meagre to support a flourishing agriculture without artificial means of regulating water supply, irrigation has played a vital role in the exploitation of agricultural resources and consequently in the distribution and redistribution of population.

> "Dependant to such a marked extent upon irrigation schemes to render the land capable of cultivation, the population flow has naturally been towards those areas able to fulfil this urgent need for water." (7)

With the development and expansion of the means of irrigation, a progressively larger area has been brought under cultivation which has served as a major incentive for the people to move to the "newly opened" or "pull" areas. As a result, the greater the extent of irrigated land, the greater the possibility of an increase in the cropland and, consequently, the greater the likelihood of a larger population size of the district.

The importance of irrigation in the region is underscored by the fact that, during 1977, Pakistan, with 10.7 per cent of Asia's and 7 per cent of the world's irrigated area, had the fifth largest irrigated tract in the world, following China, India, the USA and USSR. (8) Pakistan's total irrigated area in that year exceeded that of Europe as a whole, and the Punjab contained almost 71 per cent of the total irrigated and 68 per cent of the canal irrigated area of Pakistan during the period 1970-1/1974-5. (9)

Of the Punjab's 19 districts, three : Rawalpindi, Campbellpur and Jhelum, have an insignificant area under irrigation; in another - Sialkot - well irrigation being predominant, canal irrigation is negligible. As the results of an analysis in Table 4.4 indicate, there is a strong positive correlation between population and the irrigated area in all categories of districts. Further, in each category there is a stronger correlation between the irrigated area and rural population for obvious reasons. But, keeping in

TABLE 4.4 COEFFICIENT OF CORRELATION BETWEEN POPULATION AND IRRIGATED AREA FOR THE PUNJAB'S DISTRICTS, 1972.

No. of Districts	Tot. Irrigated &		Canal Irrigated &	
	Tot. Pop.	Rur. Pop.	Tot. Pop.	Rur. Pop.
19	+0.715	+0.810	+0.684	+0.773
16*[1]	+0.708	+0.798	+0.651	+0.735
15*[2]	+0.739	+0.874	+0.634	+0.820

Notes : *[1] Excluding Rawalpindi, Campbellpur and Jhelum

*[2] Excluding Rawalpindi, Campbellpur, Jhelum and Sialkot

SOURCES : computed from

1. District Census Reports 1972(19 volumes)
2. Season and Crop Reports 1970-1/1974-5 (5 volumes)

view the diversification of economy that has taken place during the post-Independence years with a tangible tilt towards industrialization, and also the appreciable degree of transformation of the rural society into urban, the correlation between the total population and the irrigated area is highly significant.

Agricultural land use data for the Province on a district basis are available since 1931. An analysis of the total cultivated, total cropped and net sown areas and the total as well as rural populations of the districts for various census years between 1931 and 1972 was conducted. The results are presented in Table 4.5. As is clear, the agricultural areas not only show a high positive correlation with rural population but also with total population of the districts.

The proportion of population living in the Punjab's urban settlements has gradually increased from 12 per cent in 1931 to 14.7 in 1941, 17.4 in 1951, 21.4 in 1961, and 24.4 in 1972. This is clearly reflected in the coefficient of correlation which has had a declining trend since 1931 with the exception of 1951. A higher correlation coefficient in 1951 is indicative of the massive redistribution of population due to the influx of muhajirs from India after Partition.

According to the 1951 Census, 25.6 per cent of Punjab's population consisted of muhajirs, who constituted between 5 and 46 per cent of the district populations. (10) Their main concentrations were, however, in the fertile irrigated tracts and in the towns and cities. Due to their tendency to setttle in the cultivable areas, the coefficients of correlation between the various categories of agricultural area and populations of districts reached their highest values in 1951 (Table 4.5).

It is said that in agricultural societies population distribution is often closely related to the production of staple foods. (11) A correlation analysis between the district populations and wheat as well as total food

TABLE 4.5 COEFFICIENT OF CORRELATION BETWEEN CROPPED, CULTIVATED AND NET SOWN AREA AND POPULATION FOR THE PUNJAB'S DISTRICTS, 1931-72

Year	Cropped Area & Tot. Pop.	Cropped Area & Rur. Pop.	T. cultd. Area & Tot. Pop.	T. cultd. Area & Rur. Pop.	Net Sown Area & Tot. Pop.	Net Sown Area & Rur. Pop.
1931*	+0.699	+0.685	(x)	(x)	(x)	(x)
1941*	+0.664	+0.700	(x)	(x)	(x)	(x)
1951*	+0.732	+0.854	+0.646	+0.760	+0.670	+0.801
1961	+0.698	+0.843	+0.553	+0.692	+0.641	+0.778
1972	+0.680	+0.813	+0.473	+0.649	+0.549	+0.722

* Analysis is for the 16 districts excluding Bahawalpur division.

(x) Not Available

SOURCES:- computed from -

1. District Census Reports 1972 (19 vols.)
2. Census of Pakistan, 1951
3. Rab (1961)
4. Season and Crop Reports, 1965-6/1974-5. (10 vols.)
5. Statistics of West Pakistan, Agricultural Data, 1947-8/1958-9.
6. West Pakistan Agricultural Statistics Series I (crops).

grain (wheat, rice, maize, jowar, bajra and barley) productions has proved this to be true. The results of this analysis reveal that there is a strong positive correlation between population and food production (Table 4.6).

With 75.6 per cent of its inhabitants living in small nucleated villages of fewer than 5,000 residents, the Punjab is overwhelmingly rural. Thus rural populations largely determine the pattern of overall population distribution. Nevertheless, urbanization has exerted a considerable influence in reshaping the population distribution pattern, particularly during the post-Independence period.

According to the 1972 Census, 9,182,695 people or 24.4 per cent of the Province's total population lived in 202 urban centres. A classification of these centres according to their population sizes is given in Table 4.7. As can be seen, about 15 per cent of the Province's population lives in large cities with populations exceeding 100,000 and about 8 per cent in medium-sized centres with populations of 10,000 to 100,000 ; while 56 urban centres with fewer than 10,000 residents each constitute about one per cent of the total population. The level of urbanization varies considerably between tehsils as well as districts. Apart from the Baluch Tract tehsil which is devoid of urban population, the lowest degree of urbanization is found in Kahuta (3.7 per cent) and the highest in Lahore (85.0). At the district level, the percentage of urban population varies between 64.2 in Lahore and 7.7 in Muzaffargarh. A map of rural population density is thus modified by the varying level of urbanization.

As a prelude to the analysis of population distribution, it can be summed up that, while the exploitation of water resources provided an impetus for the development of agricultural resources, and the expanding cropland, in turn, served as a catalyst for the redistribution of population, rapid urbanization accelerated the process and swelled the density figures in

TABLE 4.6

COEFFICIENT OF CORRELATION BETWEEN POPULATION, FOOD GRAIN PRODUCTION AND IRRIGATED AREA FOR THE PUNJAB'S DISTRICTS, 1972

No. of Districts	Wheat Production &		T. Foodgrain Production &		Wheat Production &		T. Foodgrain Production &	
	Tot. Pop.	Rur. Pop.	Tot. Pop.	Rur. Pop.	T. Irrig.	Canal Irrig.	T. Irrig.	Canal Irrig
19	+0.771	+0.908	+0.788	+0.911	+0.943	+0.900	+0.913	+0.814
16	+0.757	+0.898	+0.778	+0.904	+0.946	+0.874	+0.888	+0.749
15	+0.762	+0.919	+0.777	+0.906	+0.952	+0.927	+0.939	+0.856

NOTES AND SOURCES:- As in Table 4.4

TABLE 4.7 URBAN POPULATION OF THE PUNJAB BY SIZE OF URBAN CENTRES, 1972

Size	No.	Population		
		No.	% of Urb.Pop.	% of Tot.Pop.
< 5,000	16	56,778	0.6	0.1
5,000-10,000	40	312,063	3.4	0.8
10,000-25,000	92	1,400,044	15.3	3.7
25,000-50,000	29	1,013,220	11.0	2.7
50,000-100,000	11	706,696	7.7	1.9
100,000-250,000	9	1,186,573	12.9	3.2
250,000-1,000,000	4	2,337,579	25.5	6.2
1,000,000 +	1	2,169,742	23.6	5.8
TOTAL	202	9,182,695	100.0	24.4

SOURCE : Computed from : District Census Reports 1972 (19 vols)

different parts of the Province (Section 3.7). While economic factors such as industrialization and development of communications played a direct and indirect role in population distribution, minor variations were caused by such economic activities as mining, particularly in the Potwar region.

Thus, broadly speaking, the uneven character of population distribution is primarily related to :

1) the physical variants, particularly relief and climate - plain areas being more densely populated and, in the mountainous and submontane regions, tracts with plentiful rainfall having denser population.

2) the exploitation of surface and ground water resources for farming - areas with canal irrigation and the newly developed tube well irrigation having denser population.

3) the level of urbanization, indicative of rural-urban and interregional movements of people - areas with a higher level of urbanization having a higher density of population.

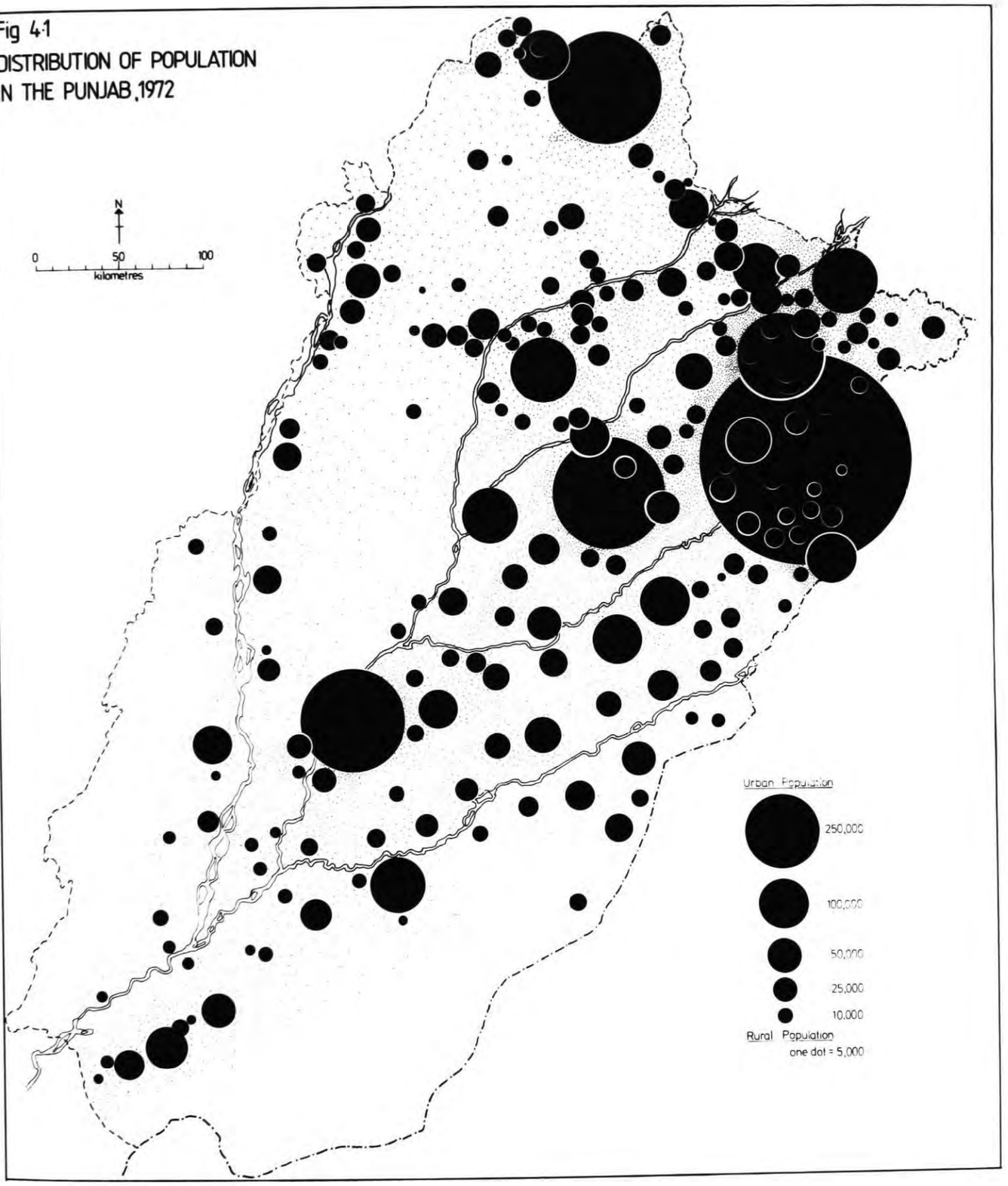
4) the expansion of rail and road networks - areas with better transport and communication systems being more densely populated, the coefficient of correlation between the arithmetic density and route density of districts being +0.664 for all districts and +0.774 for the 16 districts occupying the Punjab Plain.

5) the exploitation of mineral resources especially in the Potwar region - areas with mining activities having a higher density than their immediate surroundings.

4.3.2. Broad Patterns of Distribution

The most striking characteristic of the population distribution is its unevenness. As is indicated by Figure 4.1, the sparsely populated trans-Indus and trans-Sutlej zones bear a marked contrast with the rest of the Province.

Fig 4·1
DISTRIBUTION OF POPULATION
IN THE PUNJAB, 1972



Even within the part situated between the Indus and the Sutlej, there are sharp variations in population concentration, for instance, between the Sind Sagar and the other three doabs. Table 4.8 shows striking differences in population densities among the Province's five broad regions.

The trans-Indus zone, comprising Dera Ghazi Khan district and Isakhel tehsil of the Mianwali district, covers 12.7 per cent of the Province's area and contains only 3.4 per cent of its population, with an overall density of 49.7 and a rural density of 43 per sq. km. Only 13.4 per cent of the population is urban, marking the lowest level of urbanization amongst all the broad regions. Traversed by the Sulaiman Range, a sizeable western section of Dera Ghazi Khan district is occupied by the Sulaiman piedmont and resembles the Himalayan piedmont. Numerous streams and torrents run from the hills to the plain from west to east, making, first deeply cut and, later, broad shallow valleys. The average annual rainfall is below 250 mm and in some years considerably less which makes irrigation indispensable. Cultivation is limited and, in the piedmont area, depends upon the flood waters tapped from the seasonal hill torrents. In the more eastern flat tracts, irrigation is done by the age old system of inundation canals from the Indus. However, with the completion of the Taunsa Barrage in 1959, the northeastern section of the district is now irrigated by the Dera Ghazi Khan Canal. But,although the process of reclamation has been operative for almost two decades,the area irrigated from all sources constituted only 13 per cent of the total district area in 1975-6, out of which 10.4 per cent (80 per cent of the total irrigated) was canal irrigated. Net sown area forms only 16.3 per cent of the district territory. [12] Cultivation is precarious and crop yields are among the lowest.

Far removed from the heart of the Province, Dera Ghazi Khan district is deprived of major arteries of communication. There are a few roads, and the railway was introduced as late as 1970. Although change in the district's economic life is bound to come, it is too soon to predict its nature and magnitude. A large western part of the district is nearly empty of settlement

TABLE 4.8 POPULATION DISTRIBUTION AND DENSITY IN THE PUNJAB BY REGIONS, 1972

Region	Area		Population		Urban	Density/km^2		Nutritional Density *	
	sq.km.	% of Punjab	000	% of Punjab	%	Tot.Pop.	Rur.Pop.	Tot.Pop.	Rur.Pop.
Trans-Indus	26,102	12.7	1,296	3.4	13.4	49.7	43.0	317.7	275.1
Trans-Sutlej	45,589	22.2	3,544	9.4	16.7	77.7	64.7	269.9	224.8
Sind Sagar Doab	35,404	17.2	3,445	9.2	13.8	97.3	83.9	207.6	178.9
Potwar	22,256	10.9	3,781	10.1	28.1	169.9	122.0	403.6	290.2
Chaj-Rechna-Bari Doabs	75,994	37.0	25,544	67.9	26.9	336.1	245.6	441.7	322.9
PUNJAB	205,345	100.0	37,610	100.0	24.4	183	138	372.3	281.4

* Per sq.km. of net sown area.

SOURCES : As in Table 4.5

and the major concentrations of population are in the eastern part (Fig. 4.1). The conditions in Isakhel tehsil are more or less similar to those in Dera Ghazi Khan. With only 6.5 per cent of the tehsil's area irrigated from all sources (1.5 per cent by canals), the prospects for farming are rather poor.

The second area of scanty population, the trans-Sutlej zone comprising Bahawalpur division, contains 9.4 per cent of the Punjab's population on almost 22 per cent of the Province's territory or 13 per cent of its net sown area. The overall density is 77.7 and the rural density 64.7 per sq. km. Mean annual precipitation in the area varies between 250 mm. in the northeast and less than 125 in the southwest. Nearly 60 per cent of the division's area is occupied by Cholistan [13] characterized by sand dunes and sand ridges. However, a large part of the division has been reclaimed as a result of canal irrigation and, during the period 1970-1/1974-5, the average area irrigated from all sources was 1,368,000 ha. or 30 per cent of the division's territory. Of this, 25.6 per cent (85 per cent of the total irrigated) was canal irrigated. The net sown area during this period constituted almost 28 per cent of the total area. The process of reclamation and settlement has continued and by 1975-6 the irrigated area had increased to 1,461,000 ha . or 32 per cent of the total area [14] mainly as a result of the augmentation of canal water by tube well irrigation.

The irrigated green strip stands in sharp contrast to the barren sandy desert and thus explains marked contrasts in the population distribution. Most settlements lie in a narrow northeast/southwest belt along the northern margins of the division, close to the rivers Sutlej and Chenab, where major rail and road lines also run. In the interior, settlement is clustered wherever water is found. Usually the inhabitants choose a flat area inside the desert where they dig a large reservoir for storing rain water, called

toba, which serves as the hub of all human activity for the vicinity. (15) The other settlements in the interior, most of them new, are indicative of the expansion of irrigation and the resultant extension of cropland. The main lines of communication linking the north and south of Pakistan pass through Bahawalpur division and provide an impetus for economic development in the area; a higher population concentration is found on or close to these lines.

The third area of sparse population, the Sind Sagar Doab, lies south of the Salt Range between the Indus and Jhelum-Chenab, and is commonly known as the Thal. An overwhelming part (about 80 per cent) is a gently undulating sandy plain with arid and semi-arid conditions where rainfall is below 250 mm and highly variable, making farming virtually impossible without irrigation. However, a large area has been transformed from a semi-desert pastoral economy region into a flourishing agricultural tract since the opening, in 1947, of the Jinnah Barrage on the Indus. This has greatly influenced the distributional pattern of population in the area. It now contains 9.2 per cent of the Punjab's population on about 17 per cent of the Province's area with an overall density of 97.3 and a rural density of about 84 per sq.km. Its nutritional density (207.6 per sq.km) is the lowest among all the broad regions (Table 4.8).

An area of moderate population density but relatively meagre agricultural resources is situated in the Province's northwestern corner and consists of the Potwar upland and the Salt Range. Occupying approximately 11 per cent of the Province's total and 9.3 per cent of its net sown area, it contains almost one tenth of the Punjab's population with an overall density of about 170 and a rural density of 122 per sq.km.

Although the temperatures are extreme, the region is wetter than most parts of the Punjab. The average annual rainfall is 375-650 mm, decreasing from north to south, but in the extreme northeast it exceeds 1,000 mm. However,

a large area is affected by gully and sheet erosion which washes away the fertile soil,leaving the residual sandy to stony soil with a generally high calcareous and low organic content. (16) The deep-set character of the streams renders irrigation virtually impossible, making agriculture entirely barani or rain-fed. However, of all the broad regions, the Potwar has the highest level of urbanization (28.1 per cent)(Table 4.8). Apart from its 23 urban centres, four of which constitute 22 per cent of the region's total population, settlements are found exclusively where water exists and/or barani farming is possible. Elsewhere, excessively steep slopes and a meagre water supply combine with thin infertile soil to produce uncongenial conditions for settlement.

Some farming is practised in the tiny, fertile intermontane valleys enclosed within the Salt Range, which is otherwise known for its mineral wealth. Overall pressure on land resources is enormous and the nutritional density of the region (403.6 per sq. km) is the second highest amongst the Province's broad regions. Farming is practised wherever a cultivable patch of land is available, even on most unlikely spots such as high uneroded pinnacles of alluvium, flanks of gullies and pockets of alluvial soil in the bare rock plains. (17) However, only 42 per cent of the region's area was sown in 1973-4. Productivity is very low and the region produces only 3 per cent of the Province's wheat and 12 per cent of its maize.

Besides cultivation, settlements have been attracted by mining activity. The region is rich in mineral resources such as rock salt, gypsum, coal and oil. A number of settlements have thus cropped up around different mining sites such as Khewra, Dondot, Khaur, Dhullian, Joya Mair, Balkassar, Tut and Sarang,all of which are served by rail and road networks.

The shifting of the national capital from Karachi to Islamabad (near Rawalpindi) in 1959 had a pronounced bearing upon the Potwar's economic life. Being in the vicinity of the new capital, the pace of economic development in

the region accelerated and improvement and expansion of roads and railways stimulated commercial activity. Thus, various settlements, particularly those served by both rail and road, registered a rapid growth, resulting in a considerable degree of population redistribution in the region.

Flanked by the relatively sparsely populated areas on the west and south, is the Province's most densely populated part. Located between the Jhelum and the Sutlej, it consists of three doabs, the Chaj, Rechna and Bari, which contain respectively 10,30 and 28 per cent of the Province's population and 7, 15 and 15 per cent of its territory. Together these doabs comprise 8 out of the Punjab's 19 districts and the greater part of another two,and have almost 68 per cent of the Province's or 39 per cent of Pakistan's total population on 37 per cent of the Punjab's or 9.5 per cent of the national territory. It is in this part that the densest concentrations of population are found, the district arithmetic densities reaching as high as 654 per sq. km, with tehsil densities up to 1461. Even the rural densities at district level in the Rechna Doab exceed 350 per sq. km. Overall density of the region is 336 and the rural density 245.6 per sq. km. About 27 per cent of the population is classed as urban compared with 24.4 per cent of the Punjab as a whole.

The highest degree of population concentration in this region is explicable in broad terms by the agricultural productivity of the land, especially in less urbanized areas. Whereas in the Punjab's other parts, paucity of cultivable land or scarcity of water have restricted, to some extent, the concentration of population, this part has the highest share of agricultural area and is extensively irrigated. About 84 per cent of the area in this region is cultivated, 76 per cent is net sown. This constitutes 57.5 per cent of the total cultivated and 57.3 per cent of the net sown area of the Province and, with a fairly high degree of double cropping, the region has 62 per cent of the Province's total cropped area and produces 73 per cent of its wheat, 92 per cent of its rice, and 77 per cent of its total food grains.

The amount of water supply through rain, irrigation or both has been the chief determinant to influence population growth and distribution, followed by the next important covariant, soil quality. Extending from the Himalayan foothills in the north to the Sutlej in the south, it is an almost level alluvial plain with a gentle gradient and with height varying between 300 m. in the north and 150 in the south. Rainfall exceeds 900 mm. in the north but gradually decreases to 125 in the south. Soil fertility combined with a fairly good amount of rainfall, particularly in the northern part of the region, and a good degree of irrigation have combined to enhance the agricultural productivity.

Most of the Punjab's canal colony districts lying in this region, it has 74 per cent of the total irrigated and 67 per cent of the canal irrigated land of the Province. Further, having a higher water table, this region also enjoys a leading position in ground water irrigation with 87 per cent of the Province's well and tube well irrigated land. Since 1961, irrigation from surface water has been appreciably augmented from ground water sources,which has significantly improved crop productions and yields.

In addition to the agricultural resources, other modes of economic activity have also contributed to the pattern of population distribution in this region. Well served by good roads and railways, the region contains the major concentration of industries and thus forms the hub of all commercial and economic activities. It has also the highest concentration of urban population. With 115 of the Province's 202 total and 12 of the 15 largest urban localities, this region contains 75 per cent of the Punjab's or 41 per cent of Pakistan's urban population. Thus the region is prominent economically and outstanding in its population concentration.

4.3.3. Density of Population : Regional Variations

According to the 1972 Census, the Punjab's overall density of lation was 183 per sq. km. However, within this average there are strong

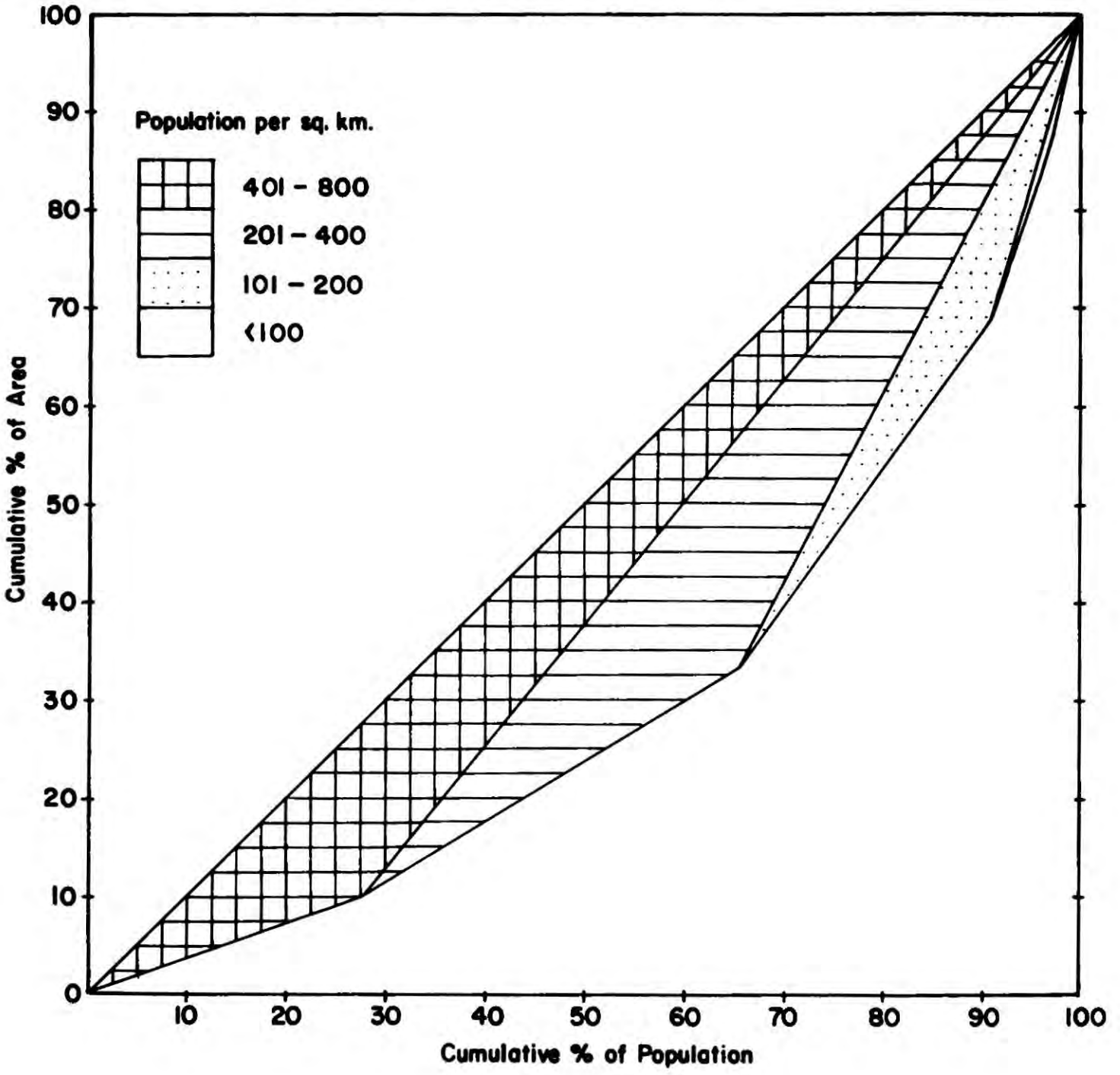
areal contrasts, with nine of the 19 districts recording densities well above the Province's average and ten districts where densities are well below that value. At tehsil level, the contrasts are more pronounced, the density range being 6 to 1461 per sq.km. and 42 of the 73 tehsils having higher density values than the Province's average.

Table 4.9 indicates the distribution of population among the 19 districts into which the Province is administratively divided and for which population data are available. Rural and nutritional densities for these districts are also shown. As is clear, arithmetic densities at the district level vary between 43 and 654 per sq.km. and Lahore, Lyallpur and Sialkot are outstanding with the highest density values. Together these three districts occupy 9.8 per cent of the Province's area and contain 27.5 per cent of its population with an overall density of 512 per sq.km. The highest level of urbanization among these three districts is in Lahore (64.2 per cent) followed by Lyallpur (24.8) and Sialkot (16.4); and about 63 per cent of the combined population of these three districts is rural which gives a rural density of 321 per sq.km. compared with 138 of the Punjab as a whole.

In sharp contrast with these districts, there are low density districts: Mianwali, Dera Ghazi Khan and Bahawalpur, each with a density below 100 per sq.km. Together these three occupy 30.7 per cent of the Province's area but contain only 8.8 per cent of its population with an overall density of 52.5. Almost 82 per cent of their population being rural, the rural density is 42.8 per sq.km, quite close to their arithmetic density.

In order to have a succinct picture of the population concentration at the district level, a Lorenz Curve with percentages of population and area is plotted in relation to the arithmetic density classes (Fig. 4.2). It shows, in addition to the contrasts outlined above, that the highest share of population (38 per cent) is contained by six districts : Gujranwala, Rawalpindi, Gujrat, Sheikhupura, Multan and Sahiwal. The arithmetic densities

Fig 4·2
LORENZ CURVE OF POPULATION CONCENTRATION IN THE PUNJAB (ON DISTRICT BASIS), 1972



in these districts vary between 259 and 344, and rural densities between 185 and 276 per sq. km.

A more detailed picture of the regional variations in population distribution emerges if the density map is constructed for smaller areal units. This is drawn on the basis of the Punjab's 73 tehsils, the smallest areal unit for which population statistics are available in Pakistan (Fig. 4.3). The whole Province is divided into six density categories. The highest tehsil densities are found in the central districts located between the Jhelum and the Sutlej. The only other area of high density is Rawalpindi tehsil. Following is a brief account of each density class.

DENSITY OVER 800 PER SQ. KM.

The highest density of population occurs in Lahore (1,461 per sq.km) and Lyallpur tehsil (850). This can obviously be related to the great urban, commercial and industrial development of the two areas. Lahore and Lyallpur being the largest cities in the Province, the level of urbanization is the highest in Lahore tehsil (85 per cent) and the third highest in Lyallpur (49.2) which has obviously inflated the density value. In addition, both are located within the Province's flourishing agricultural tracts and thus support sizeable rural populations.

Lahore has been the Punjab's capital for almost a thousand years. (18) During the pre-Independence period, it was the capital of British Punjab which for some time also included the present NWF province. Then, from 1955 to 1970, it remained the capital of West Pakistan (the present Pakistan). Situated in the heart of the fertile Upper Indus Plain, Lahore has been the Punjab's cultural and educational centre for centuries. Connected with all the important urban, industrial and commercial centres of the Province through good road and rail networks, it enjoys a focal position in the Province and is itself a great industrial centre and a principal trade market. The area within its proximity is agriculturally prosperous with an adequate system of surface

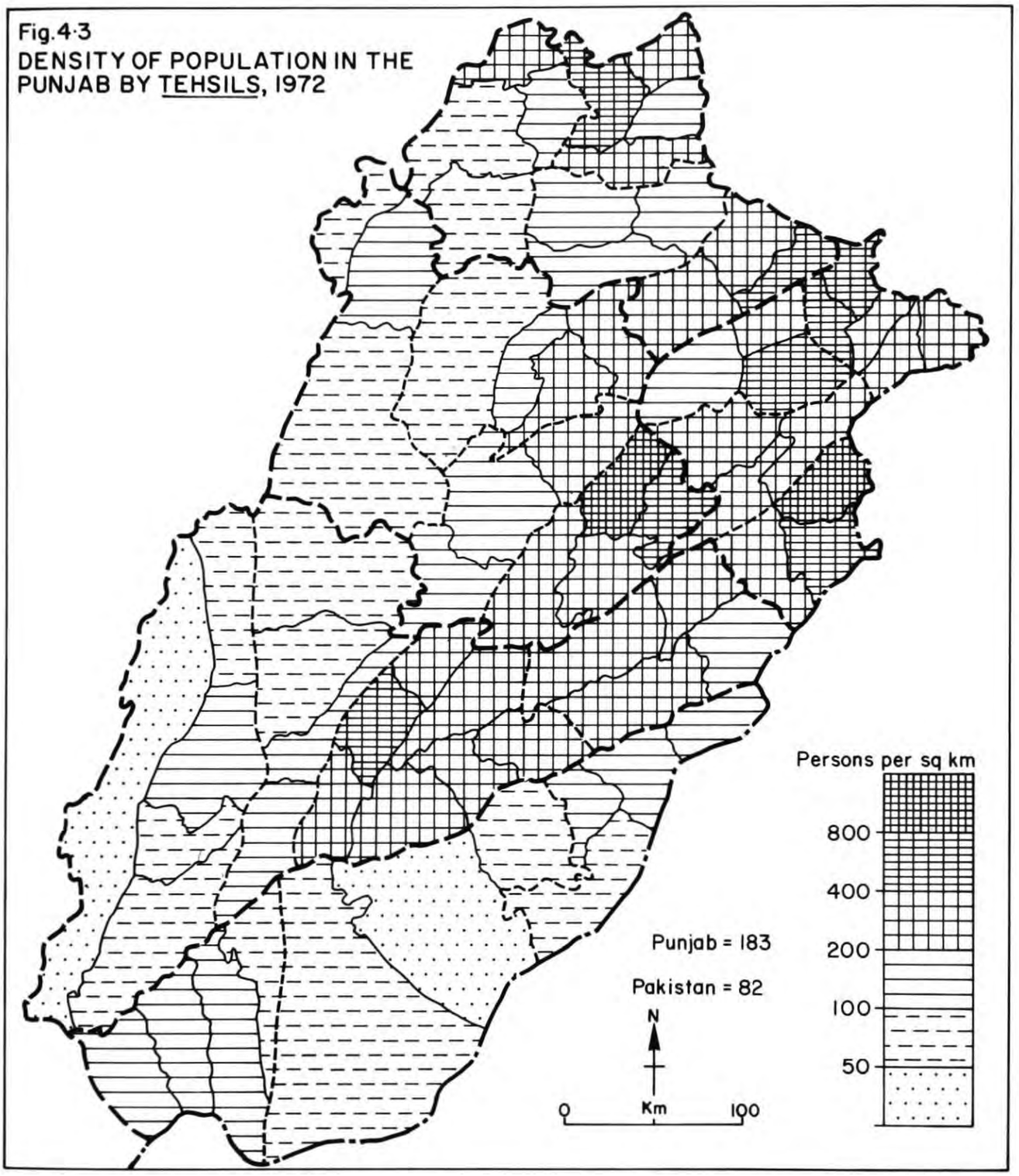


Fig.4·3
DENSITY OF POPULATION IN THE
PUNJAB BY TEHSILS, 1972
Persons per sq km
800
400
200
100
50
Punjab = 183
Pakistan = 82
N
0
Km
100

and ground water irrigation. The rural density of Lahore tehsil is 219.5 in contrast to 409.1 of its southern neighbour, Kasur and 138 per sq. km. of the Punjab as a whole.

Lyallpur, the Province's second largest urban centre is the district town in one of the earliest "colonized" areas which made great strides with the development and expansion of irrigation. Being the fastest growing region in the Punjab, the Lyallpur district, in fact, presents the most striking illustration of the population redistribution as a result of irrigation expansion. Lyallpur city's spectacular growth since 1891, particularly since Independence, is closely linked with the prosperity of the region in which it lies. As a great industrial, commercial and educational centre, the city has a great bearing upon its surrounding area. Lyallpur's tehsil territory surrounding the city is markedly productive where surface and ground water irrigation is highly developed and modern methods of cultivation are widely employed. Besides, there exists a developed network of road and rail. As in arithmetic density and urban population size, Lyallpur tehsil, with a rural density of 431 per sq. km., ranks second in the Province, after Sialkot (436.6).

DENSITY 400-800 PER SQ. KM.

The second highest population density is recorded by eight tehsils, four of which : Gujrat (427 per sq. km), Sialkot (638), Daska (477) and Gujranwala (514), constitute a contiguous block in the northeastern part of the Province. The other four : Rawalpindi (498 per sq.km), Jaranwala (408), Kasur (556), and Multan (576) are scattered all over (Fig. 4.3). The degree of urbanization in these tehsils varies between the lowest in Jaranwala (6.3 per cent) and the highest in Rawalpindi (72.7). Rural density is generally very high and, with the exception of Rawalpindi where it is 135.8 per sq.km, all tehsils experience more than twice the Provincial average of 138, with the highest in Sialkot (436.6) where it is more than

three times the Provincial figure.

Kasur and Jaranwala are largely influenced by their nearness to the densest tehsils - Lahore and Lyallpur respectively. Situated within the "sphere of influence" of the two principal urban-industrial - commercial regions, Kasur and Jaranwala receive a great impact of the economic progress being experienced and diffused by those regions. In addition, fertile land and abundant water supply through irrigation has made these tehsils agriculturally rich.

Rawalpindi, because of its closeness to the national capital Islamabad and with its flourishing industrial and commercial activity, is a rapidly growing urban region. A nodal point of rail and road communication, it is the most important urban centre of the Potwar region. Although the tehsil territory surrounding Rawalpindi is not propitious from an agricultural point of view, urbanization with its associated functions, is largely responsible for the tehsil's high population density.

Multan, an ancient city of great significance, is situated in another early "colonized" area. The expansion of irrigation arteries and, in recent years, the development of tube well irrigation, has appreciably increased the cultivable area and land productivity and converted the tehsil into the country's principal fruit producing region. Besides being a prominent centre of industries, it is an important rail and road junction and scores of its shrines scattered in and around the city have long attracted pilgrims from far and wide, making it a prominent area of in-migration.

The four tehsils forming a contiguous block in the Province's extreme northeast are located in the old settled districts where soil is very fertile, rainfall exceeds 650 mm. and water table is high enough to facilitate well irrigation. Therefore, irrigation from ground sources has been an age old practice in these areas. Consequently, they were densely populated even before the advent of modern irrigation. Except Gujranwala, where canal diver

irrigated land constitutes 37 per cent of the total irrigated, an overwhelming part of irrigation in these tehsils depends upon ground water sources. In addition, with the exception of Daska, these tehsils have been advanced industrially and important commercially since long. Daska, on the other hand, has recorded a rapid expansion of commerce and industry between 1961 and 1972, due mainly to the "Green Revolution".

DENSITY 200-400 PER SQ. KM.

Twenty seven tehsils fall into this density range. Except three : Gujar Khan, Murree and Campbellpur, which lie in the extreme north of the Province close to the national capital, all are situated in the Chaj, Rechna and Bari doabs in a contiguous block which is only slightly interrupted by the higher density tehsils.

Situated in the main fertile and extensively irrigated tract, they constitute important farming areas. Their rural density ranges between 180 in Chiniot and 344 per sq. km. in Pasrur, and reflects the importance of agricultural activity. In fact, they constitute the major wheat, rice, cotton and sugarcane producing region not only of the Province but of Pakistan and occupy a dominant part of the Province's most densely peopled strip that lies between the Jhelum and the Sutlej, where tehsil densities are universally in excess of 200 per sq. km, except in only four out of the thirty seven tehsils. The agricultural and rural nature of the economy in these tehsils is also reflected by their low level of urbanization. With the exception of Sargodha, where urban population constitutes 29.3 per cent of the total, in all tehsils in this category, the level is much below the Provincial average of 24.4 per cent. However, a number of towns with mandi (market) functions are important commercially. In addition, with the installation and expansion of agro-based and other industries, the industrial development is taking place at a fast pace. As a result, the pattern of economy in these tehsils is undergoing a diversification.

DENSITY 100-200 PER SQ. KM.

Twenty tehsils experience densities between 100 and 200 per sq. km. Situated mainly in the districts of Jhelum, Muzaffargarh, Bahawalnagar and Rahimyar Khan, they form patches on the periphery of the more densely populated central tehsils.

Five of these tehsils lie in the Potwar region, where conditions are not quite congenial for farming, cultivable area limited;and the agriculture, almost entirely rain-fed, is precarious. As a result, the pressure on land is enormous. Oil, coal and salt mining are the region's main economic activities. However, with the development of roads and railways in the recent past, commercial activity has increased.

In most other tehsils in this category, irrigation had a late start. In the trans-Sutlej tehsils of Bahawalnagar and Rahimyar Khan districts, canal water was introduced between 1921 and 1933. However, reclamation of a dreary wasteland like Cholistan was a tremendous job. Thus, although agricultural development has been taking place at a fast rate, particularly after Independence, in efficiency it is still far from the level attained by the central doabs. Such is also the situation in Mianwali tehsil where canal water was introduced in 1947;and in Dera Ghazi Khan, Muzaffargarh and Alipur tehsils where canal irrigation began in 1959. Rural densities in these tehsils range between 95 and 178 per sq. km. in the Potwar and between 72 and 174 in the plain areas.

Most tehsils in this class, with the exception of those in the Rahimyar Khan district, are far removed from the Province's major developed areas and main communication arteries. However, commercial activity is picking up with increasing urbanization;and industrialization is also taking place particularly in Mianwali and Rahimyar Khan, but the overall level is low.

DENSITY 50-100 PER SQ. KM.

Fourteen tehsils of this category lie between the Indus and Jhelum and

also in the trans-Indus and trans-Sutlej zones and their low density is reflective of their less favourable economic conditions. The percentage of arable land in these tehsils is very low and they are lagging in industrial development as well, which is equally reflected in their low level of urbanization.

A large part of the Mianwali and Muzaffargarh districts alongwith Khushab tehsil of the Sargodha district forms what is known as Thal. A rolling sand plain, it is, in its natural state, nothing more than a desolate wasteland and,unlike other doabs, lacks alluvium with its surface covered by wind blown sand. (19) Despite the introduction of canal irrigation, the percentage of cultivated land was 56.5 of the total in Mianwali district and 45.5 in Muzaffargarh during the period 1970-1/1974-5,while the net sown area during the same period was 49.1 and 41.6 per cent of the total respectively. Agricultural data at tehsil level are not available but, since the district tehsils in these two districts, as in most other districts, have a higher density than their counterparts in the same district, it can be assumed that the percentage of agricultural areas would be much lower in the low density tehsils. Besides, productivity of cultivated land is very low.

In the trans-Sutlej tehsils of Bahawalpur division, a good deal of reclamation has taken place during the last 50 years or so. However,a large part is still a barren, sandy desert and the cultivated area in Bahawalpur district is only 14.2 per cent of the total and it is likely to be very low in the adjoining tehsils - Fort Abbas of Bahawalnagar and Liaqatpur of Rahimyar Khan districts. This uncongenial economic climate explains, to a large extent, the low density of population in these tehsils.

DENSITY LESS THAN 50 PER SQ. KM.

The lowest population density occurs in two tehsils, Bahawalpur (32 per sq. km) and Baluch Tract (6). In area, the largest tehsils in the Province, they together cover 12.6 per cent of the Punjab's territory but contain only

1.5 per cent of its population. Rural density in Bahawalpur is 22.6 per sq. km, while it is 6 in Baluch Tract, equal to its arithmetic density since 100 per cent of its population is rural.

In Baluch Tract - the only tehsil without a trace of urbanization - extremely unfavourable economic conditions, very low percentage of cultivated land, remoteness from the prosperous areas as well as from the major trade routes and communication lines,have combined with the tribal "obscurantism" of its people to create unhealthy conditions for a dense population. Bahawalpur, despite being well served by the country's major rail and road links, is handicapped due to extremely low ratio of its cultivated land. Having remained the capital of the erstwhile princely state, Bahawalpur enjoyed a degree of prominence in the past. Having grown more than three fold since Independence , it is now the nineth largest urban centre in the Province. Thus, the level of urbanization in the Bahawalpur tehsil (29.4 per cent) is not only higher than that of the Province as a whole, but is one of the highest among the 73 tehsils, outclassed by only seven tehsils. A large part of the desert landscape in the tehsil, particularly in the immediate surroundings of Bahawalpur city,has been transformed into a flourishing farmland. However, all the gains made by such reclamation process have been diluted by the great areal size of the tehsil and the overall ratio of the cultivated land has remained extremely low. As a result, its arithmetic density has fallen to the second lowest in the Province.

4.4. CHANGE IN POPULATION DISTRIBUTION

4.4.1. Shift in the Mean and Median Points

In order to study areal shifts in population distribution, geographers have employed a variety of statistical measures. Of these,the mean point, because of its high sensitivity to the extreme values and to the movements within the distribution, is most suitable for determining the extent of areal

TABLE 4.9

POPULATION DISTRIBUTION AND DENSITY IN THE PUNJAB BY DISTRICTS, 1972

District	Area		Population		Urban	Density/km^2		Nutritional Density	
	Sq.km.	% of Punjab	No.	% of Punjab	%	Tot. Pop.	Rur. Pop.	Per km^2 Net Sown Area Tot.Pop.	Rur.Pop.
1. RWP	5,286	2.6	1,747,685	4.7	44.2	331	185	621	347
2. CPR	9,790	4.8	981,734	2.6	12.5	100	88	253	222
3. JLM	7,179	3.5	1,051,864	2.8	16.0	147	123	393	330
4. GJT	5,864	2.9	1,899,178	5.1	14.7	324	276	439	375
5. SRG	12,367	6.0	2,100,955	5.6	23.5	170	130	238	182
6. MWI	13,993	6.8	1,095,632	2.9	21.6	78	61	147	116
7. JNG	8,809	4.3	1,561,006	4.2	18.2	177	145	289	237
8. LYP	9,106	4.4	4,241,785	11.3	24.8	466	350	603	453
9. LHR	5,768	2.8	3,774,007	10.0	64.2	654	234	997	357
10. SLT	5,354	2.6	2,343,925	6.2	16.4	438	366	585	489
11. GWA	5,988	2.9	2,059,755	5.5	28.7	344	245	550	393
12. SHA	5,960	2.9	1,657,149	4.4	14.8	278	237	408	348
13. MTN	14,574	7.1	4,007,456	10.7	22.1	275	214	366	286
14. SWL	10,940	5.3	2,836,889	7.5	13.7	259	224	334	288
15. MZG	14,538	7.1	1,564,895	4.2	7.7	108	99	240	222
16. DGK	24,240	11.8	1,142,448	3.0	12.9	47	41	289	252
17. BWP	24,830	12.1	1,071,026	2.8	21.0	43	34	350	276
18. BWN	8,879	4.3	1,073,891	2.8	15.3	121	102	217	184
19. RYK	11,880	5.8	1,398,879	3.7	14.6	118	101	273	233
PUNJAB	205,345	100.0	37,610,159	100.0	24.4	183	138	379	281

SOURCES : As in Table 4.4

shifts in distributions over a period of time. (20) Median point, on the other hand, is the most stable index of "Central Tendency" and is regarded as the best single index of centrality. (21)

In the case of the Punjab, the mean and median points of population distribution were calculated for 1951, 1961 and 1972,on the assumption that the tehsil towns represent the total population of the respective tehsils. The Province's entire population is thus represented by 73 points, the southernmost of which is Sadiqabad (28.28°N 70.12°E) and the northernmost Murree (33.88°N 73.42°E). The coordinates of the mean and median points for different years are presented in Table 4.10.

As is evident, in 1961 the mean point had shifted a little southwestwards from its 1951 position. This was linked with the completion and expansion of the Jinnah and Taunsa irrigation schemes which greatly benefitted the Sind Sagar Doab, as well as the extension of irrigation in the Bahwalpur division. This resulted in opening new "pull" areas in the western and southern parts of the Province through an extension of the cultivable land.

By 1972, the mean point had moved a little northeastwards to occupy a position between those of 1951 and 1961, indicating a higher degree of urbanization in the Province's northern and eastern parts. As is clear from Table 4.10, the median point closely followed the mean point. However, the overall areal shift of population distribution expressed by the mean and median points has been rather insignificant during the period 1951-72 and both these points have stayed within Lyallpur tehsil, quite close to the Lyallpur city.

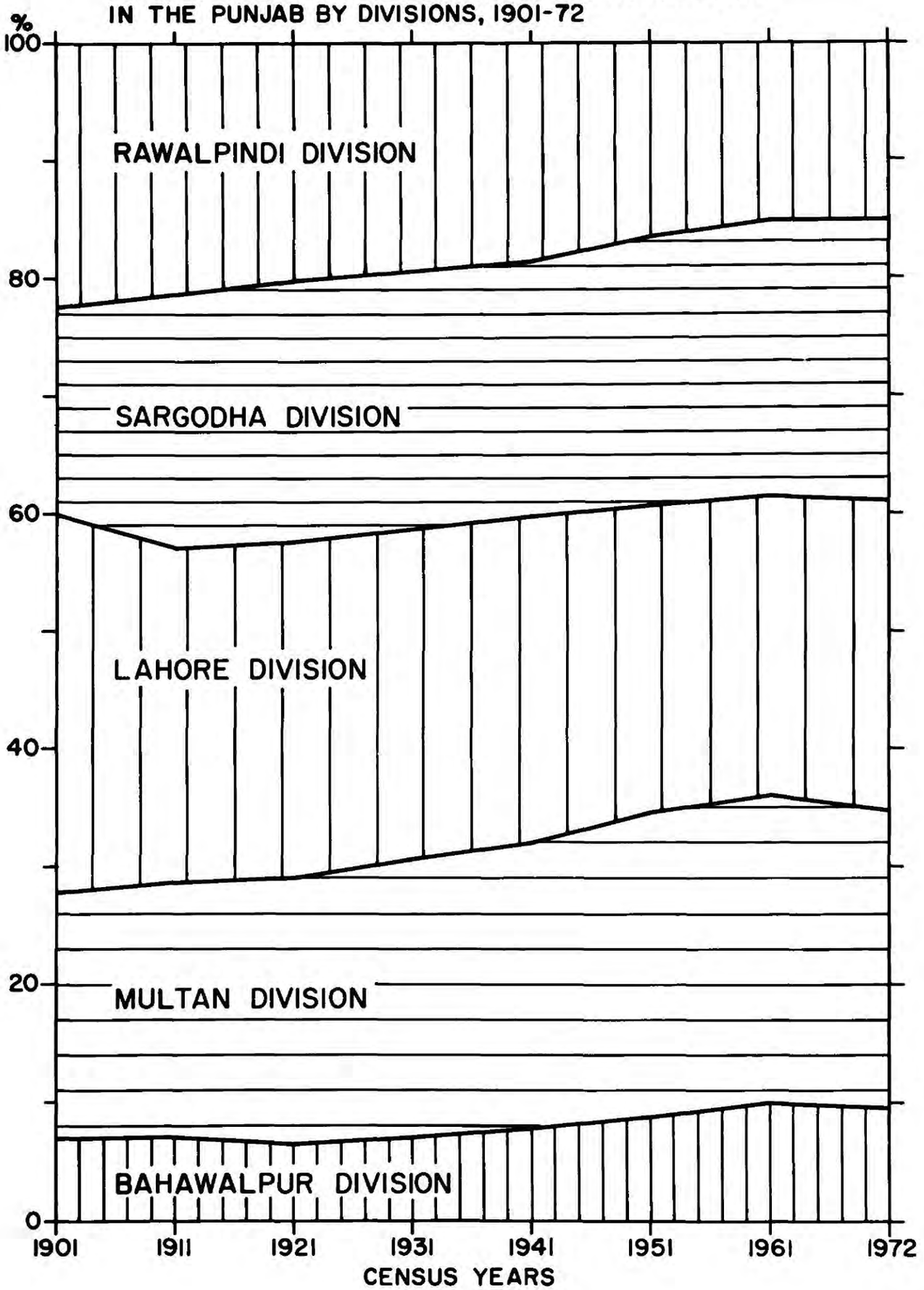
These measures of areal shift in population distribution are, however, inadequate partly because of the assumptions involved and also because of being limited in scope. The population data on a tehsil basis are not available for the pre-1951 period which renders comparison before that date impossible.

TABLE 4.10 COORDINATES OF THE MEAN AND MEDIAN POINTS OF TEHSILS' TOTAL POPULATIONS IN THE PUNJAB, 1951-72

Year	Mean Point		Median Point	
	^{o}N	^{o}E	^{o}N	^{o}E
1951	31.32	72.93	31.53	73.27
1961	31.25	72.87	31.52	73.20
1972	31.27	72.90	31.55	73.23

SOURCE : Computed by the author

Fig. 4·4
PERCENTAGE DISTRIBUTION OF TOTAL POPULATION
IN THE PUNJAB BY DIVISIONS, 1901-72



4.4.2. Variation in Percentage Shares

A better picture of the variation in population distribution is provided by the changing shares of population amongst the constituent areal units of the Punjab. Table 4.11 and the accompanying diagram (Fig. 4.4) give percentage distribution of total population by divisions during the period 1901-72. As is clear, there has been a considerable variation in the divisions' percentage shares of the Province's total population during various decades, which points out the interplay of a variety of influences particularly the varying scale of economic development in these areas.

Between 1901 and 1951, the largest decline (6.3) in the percentage share of the Province's population was registered by Lahore division followed by Rawalpindi (5.8). The slump in Lahore's share is quite significant keeping in view the presence of numerous important urban centres in this division besides the metropolis Lahore. Rawalpindi division obviously lagged behind in agricultural prosperity compared with the newly colonized areas. The highest gains in the percentage shares, on the other hand, were shown by Sargodha (5.5) and Multan (4.8) which can be attributed to the vast colonization schemes executed in these areas.

From 1951 to 1972, Rawalpindi and Multan divisions experienced a decline of 1.5 and 0.3 percentage points respectively, while Lahore's share improved by 0.3. Lahore's rise vis-a-vis Multan's fall can be explained mainly in terms of differential population growth in these divisions. Although Lahore experienced a smaller degree of population growth in urban and rural sectors - 138.1 and 62.5 per cent respectively - compared with Multan's 146 and 71.2 per cent, the overall population growth in Lahore division during the period 1951-72 was higher (84.2 per cent) vis-a-vis Multan's (80.0). In the overall percentage shares of total population during the period 1901-72, Rawalpindi and Lahore registered a decline, while the other three divisions gained.

An almost similar trend was demonstrated by the percentage distribution

TABLE 4.11

PERCENTAGE DISTRIBUTION OF TOTAL POPULATION IN THE PUNJAB BY DIVISIONS, 1901-72

Division	1901		1911		1921		1931		1941		1951		1961		1972		Change in Percentage		
	000	% of Pjb	000	% of Pjb	000	% of Pjb	000	% of Pjb	000	% of Pjb	000	% of Pjb	000	% of Pjb	000	% of Pjb	1901-51	1951-72	1901-72
Rawalpindi	2,317	22.4	2,367	21.5	2,383	20.3	2,682	19.3	3,196	18.6	3,439	16.6	3,885	15.2	5,680	15.1	-5.8	-1.5	-7.3
Sargodha	1,802	17.5	2,348	21.4	2,617	22.2	3,065	22.1	3,723	21.7	4,743	23.0	5,977	23.5	8,999	23.9	+5.5	+0.9	+6.4
Lahore	3,321	32.2	3,114	28.3	3,350	28.5	3,872	27.9	4,760	27.7	5,340	25.9	6,449	25.3	9,835	26.2	-6.3	+0.3	-6.0
Multan	2,153	20.9	2,381	21.7	2,629	22.4	3,271	23.6	4,148	24.2	5,306	25.7	6,603	25.9	9,552	25.4	+4.8	-0.3	+4.5
Bahawalpur	721	7.0	781	7.1	781	6.6	985	7.1	1,341	7.8	1.823	8.8	2,574	10.1	3,544	9.4	+1.8	+0.6	+2.4
PUNJAB	10,314	100.0	10,991	100.0	11,760	100.0	13,875	100.0	17,168	100.0	20,651	100.0	25,488	100.0	37,610	100.0	-	-	-

SOURCE : Computed from District Census Reports 1972 (19 vols)

TABLE 4.12 PERCENTAGE DISTRIBUTION OF RURAL POPULATION IN THE PUNJAB BY DIVISIONS, 1901-72

Division	1901		1911		1921		1931		1941		1951		1961		1972		Change in Percentage		
	000	% of Pjb	000	% of Pjb	000	% of Pjb	000	% of Pjb	000	% of Pjb	000	% of Pjb	000	% of Pjb	000	% of Pjb	1901-51	1951-72	1901-72
Rawalpindi	2,129	22.7	2,169	21.7	2,165	20.4	2,411	19.8	2,795	19.1	2,889	16.9	3,133	15.6	4,339	15.2	-5.8	-1.7	-7.5
Sargodha	1,671	17.8	2,192	21.9	2,406	22.7	2,765	22.6	3,308	22.6	4,053	23.8	4,805	24.0	6,932	24.4	+6.0	+0.6	+6.6
Lahore	2,928	31.3	2,695	27.0	2,859	26.9	3,096	25.3	3,589	24.5	3,811	22.3	4,254	21.2	6,193	21.8	-9.0	-0.5	-9.5
Multan	1,967	21.0	2,193	21.9	2,438	23.0	2,991	24.5	3,725	25.4	4,680	27.4	5,616	28.1	8,013	28.2	+6.4	+0.8	+7.2
Bahawalpur	679	7.2	744	7.5	750	7.0	948	7.8	1,225	8.4	1,631	9.6	2,219	11.1	2,950	10.4	+2.4	+0.8	+3.2
PUNJAB	9,374	100.0	9,993	100.0	10,618	100.0	12,211	100.0	14,642	100.0	17,064	100.0	20,027	100.0	28,427	100.0	-	-	-

SOURCES : Computed from 1. District Census Reports 1972 (19 vols)
2. Census of Pakistan 1961.

of rural population in these divisions (Table 4.12). This means there is a close link between the distribution of rural population and that of the total population. In fact, rural population has, to a large extent, determined the pattern of total population distribution in the Province. Therefore, the rise and fall in a division's share of the Province's total population depends mainly on the fluctuations of its share of the Province's rural population.

Rural population, in turn, depends mainly upon the extent of cultivable area which is closely linked with water availability. Thus, with the expansion of modern irrigation, the balance of population has been swinging between various areal units.

4.4.3. Changes in Ranks

By organizing the constituent areal units of the Province in a rank order for different census years, the changes in population distribution can be viewed from a different angle. A comparison of ranks from one census to another reveals a number of changes which inevitably hint at the impact of a variety of influences.

Figure 4.5(a) shows the ranking in descending order of the Punjab's 19 districts in their total populations for eight different censuses since 1901,while Figure 4.5(b) indicates their ranks in rural populations for the same period. Two conspicuous models emerge. The first consists of those districts which have constantly improved their ranks mainly as a result of the "revolutionary" cycle set up in the region's economy by the irrigation development. They comprise the early colonized districts of Lyallpur, Sahiwal, Multan and Sargodha which have shown increases of 624, 560, 472 and 330 per cent respectively in their total populations between 1901 and 1972, compared with the Provincial average of 265 per cent. This category also includes the districts where irrigation was introduced rather late, shortly before and largely after Independence. The examples are : Rahimyar Khan, Muzaffargarh,

Fig 4·5(a)

RANKING OF DISTRICTS IN TOTAL POPULATION, 1901 - 72

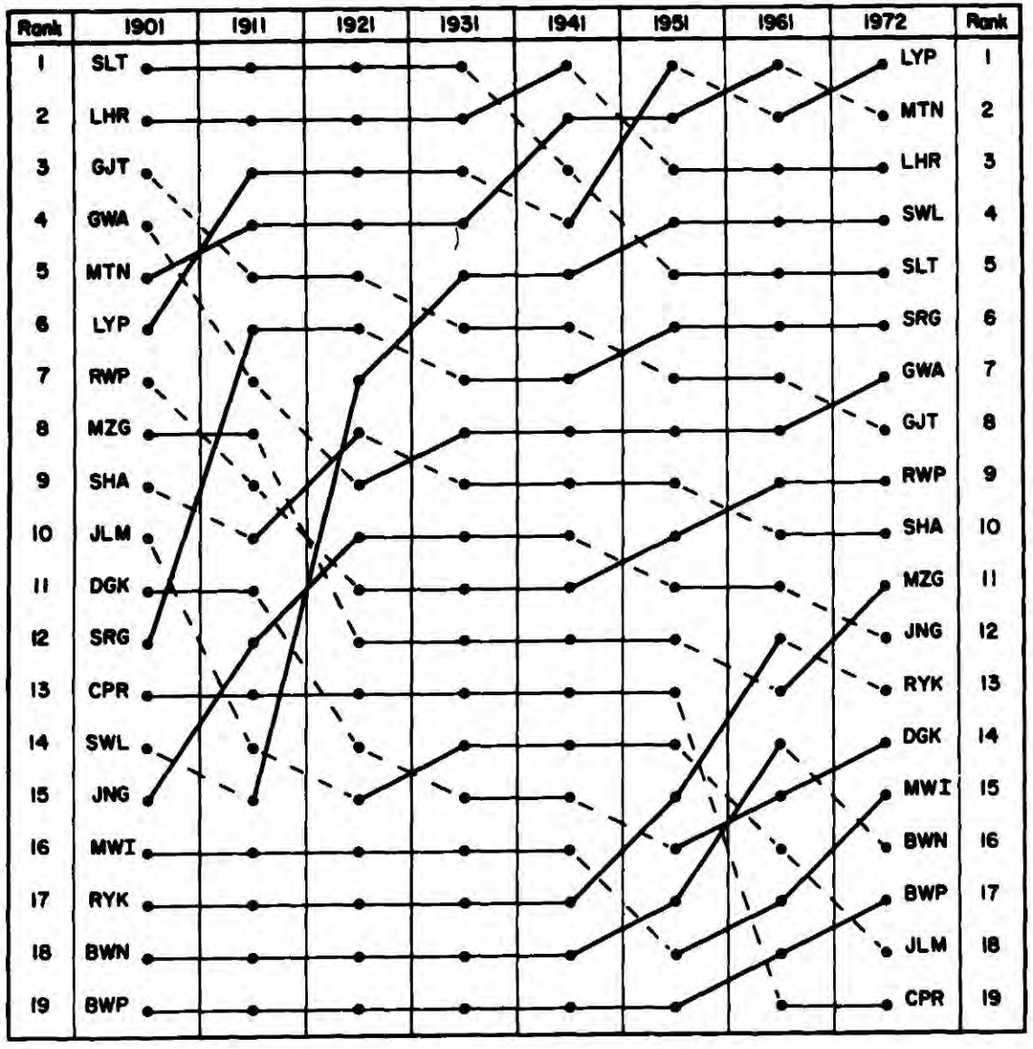
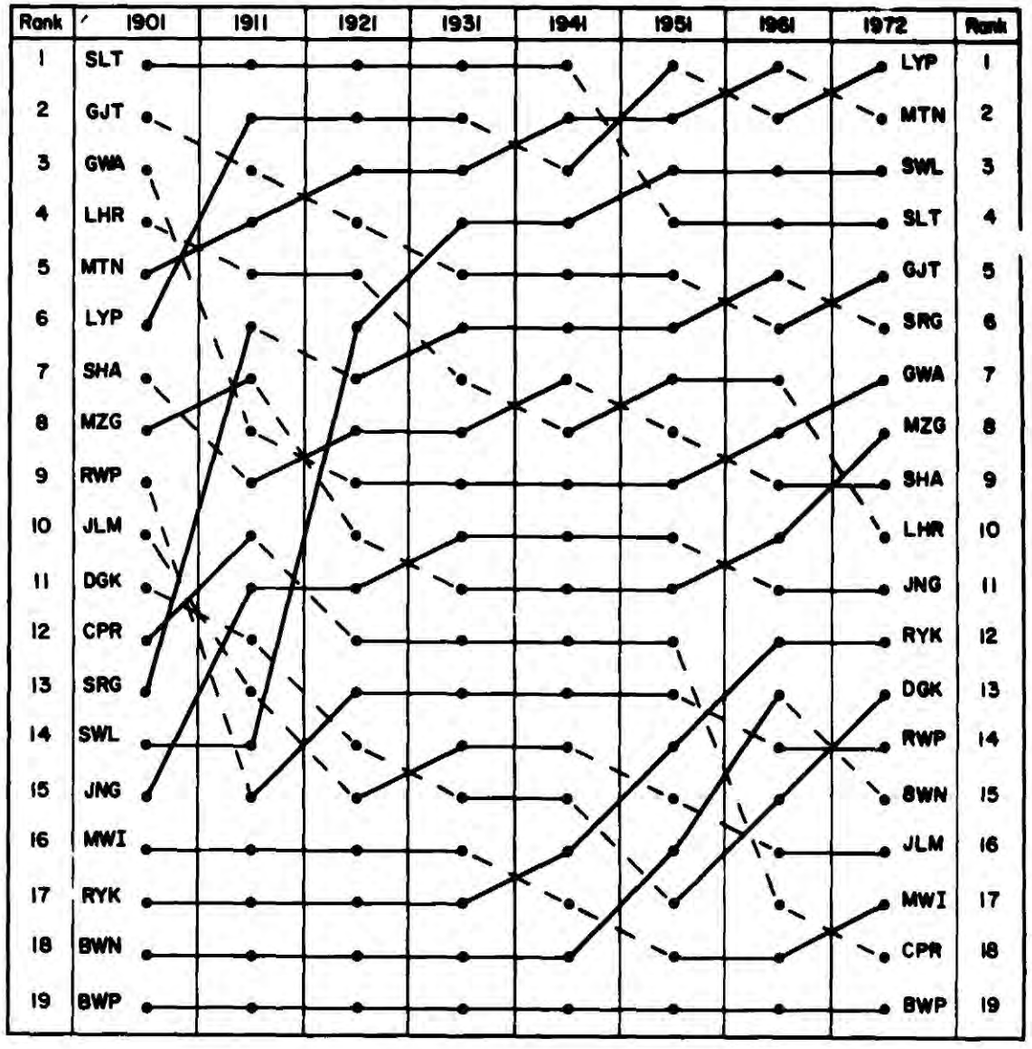


Fig 4·5(b)

RANKING OF DISTRICTS IN RURAL POPULATION, 1901 - 72



Bahawalpur and Mianwali which, with 111, 108, 103 and 99 per cent increases in their total populations respectively, marked the highest gains during the period 1951-72 in contrast to the Provincial average of 82.

The second model consists of those districts which, in the absence of large scale modern irrigation, could not expand their food base. Their meagre agricultural resources, therefore, relegated them to the lower positions. The principal examples are : Campbellpur, Jhelum, Gujrat and Sialkot which registered the lowest population increases between 1901 and 1972 - 111, 110, 140 and 101 per cent respectively.

The position of Dera Ghazi Khan is similar to that of Muzaffargarh of the first category. Situated on the historic trade route linking the Moghul India with Afghanistan and Iran, the district had enjoyed a prominent position in historical time. It had, in fact, been one of the "gateways" of India. (22) In total population it occupied eleventh position amongst the Punjab's districts in 1901, but was relegated to the sixteenth by 1951. However, it has gradually improved its ranking during the two decades following 1951 mainly due to the Taunsa irrigation project.

Whereas the most spectacular rise is that of Lyallpur and Sahiwal, perhaps the most eye-catching decline is that of Sialkot (Fig. 4.5). It maintained its prime position until 1931 but lost it sharply afterwards. Thus 1931 was, in a way, a turning point in the status of this district. In fact, this period was marked by momentous progress in irrigation technology with the completion of the gigantic Sutlej Valley Project (1921-33). As well as this was the period when the stupendous investment made in other irrigation schemes started paying dividends. As a result, the colonization schemes undertaken earlier began making a tangible headway. Therefore, districts such as Lyallpur, Multan and Sahiwal outclassed Sialkot, mainly as a result of internal migration.

Sialkot's nearness to the Indo-Pakistan border particularly to the sensitive region of Kashmir has, to some extent, contributed to its lower ranking

after Independence. However, situated on the submontane strip, the district has an adequate system of groundwater irrigation and contains 6.2 per cent of the Punjab's total and 6.9 per cent of its rural population on 2.6 per cent of the total and 4.1 per cent of the net sown area of the Province. Its ranking in rural population is, therefore, higher than in total population.

A collation between Figures 4.5(a) and (b) reveals that the rankings of various districts in rural and total populations are almost identical, indicating a close association between the variations in the two population types.

4.4.4. Variation in Population Density

Changes in population density are far more revealing than those expressed by the fluctuations in percentage shares or the rankings. Table 4.13 indicates the arithmetic density by divisions and districts in the Province for the period 1901-72. It also shows the rural and nutritional densities for the 1951-72 period. As can be seen, between 1901 and 1951, the Punjab's population density rose by 51 per sq. km. compared with 21 of Pakistan as a whole. Among the Punjab's districts the highest changes were experienced in Lahore (175 per sq. km), Lyallpur (172), Sahiwal (127) and Multan (97).

Between 1951 and 1972, Lahore again experienced the highest change in its population density (325 per sq. km) followed by Lyallpur (230) and Gujranwala (169) in contrast to the Punjab's overall increase of 82 and Pakistan's 40 per sq. km. Overall increase in population density from 1901 to 1972 was 133 per sq. km. in the Punjab as a whole and 61 in Pakistan. In contrast, Lahore and Lyallpur districts experienced a change of 500 and 402 respectively. The lowest increases in population densities during this period were shown by Dera Ghazi Khan (27 per sq. km), Bahawalpur(35) Campbellpur (53) and Mianwali (56).

The district arithmetic densities for various years shown in Table 4.13 are plotted in Figure 4.6 on a uniform scale to facilitate easy comparison. It is clear from these maps (Fig. 4.6(a)-(b)) that in 1901 there was only one

TABLE 4.13

DENSITY OF POPULATION IN THE PUNJAB BY DIVISIONS AND DISTRICTS, 1901-1972

Persons per sq.km.

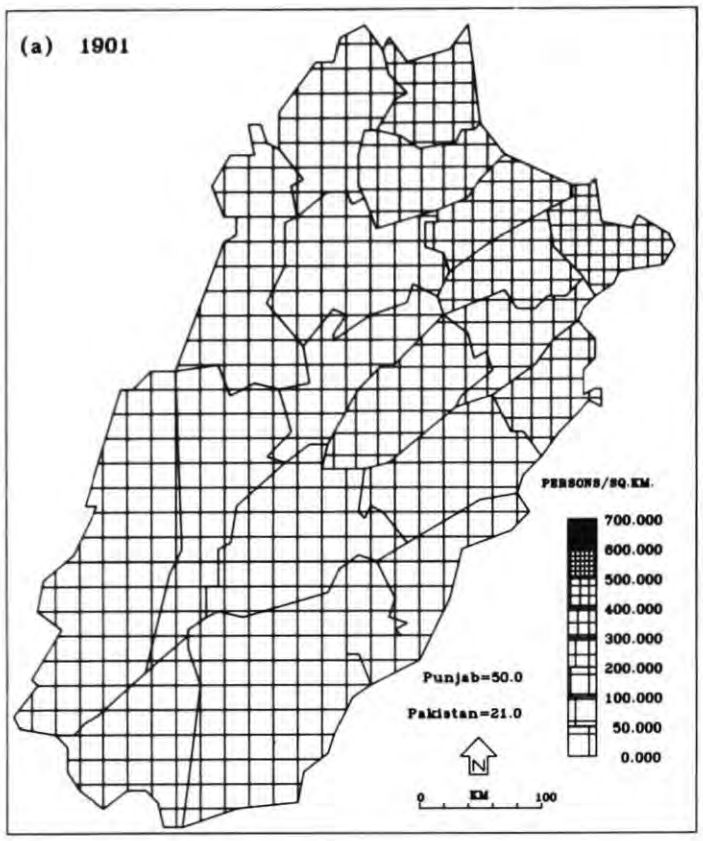
Division/District	1901	1911	1921	1931	1941	1951	1961	1972	Change 1901-51	Change 1951-72	Change 1901-72	Rural Density (1) 1951	Rural Density (1) 1961	Rural Density (1) 1972	Nutritional Density (2) 1951	Nutritional Density (2) 1961	Nutritional Density (2) 1972
I. RAWALPINDI DIV.	82	84	85	95	114	122	138	202	40	80	120	103	111	154	268	291	415
1. RWP	106	104	108	120	149	172	210	331	66	159	225	117	133	185	409	477	621
2. CPR	47	53	52	60	69	71	72	100	24	29	53	65	64	88	171	173	253
3. JLM	70	71	66	75	88	95	104	147	25	52	77	84	90	123	258	275	393
4. GJT	135	134	141	157	188	198	226	324	63	126	189	176	197	276	293	311	439
II. SARGODHA DIV.	41	53	59	69	84	107	135	203	66	96	162	92	109	157	220	239	314
5. SRG	39	52	58	66	81	94	119	170	55	76	131	77	96	130	182	194	238
6. MNI	22	24	26	29	36	39	53	78	17	39	56	35	43	61	130	134	147
7. JNG	48	60	65	75	93	100	122	177	52	77	129	84	103	145	199	209	289
8. LYP	64	92	106	128	153	236	295	466	172	230	402	205	232	350	331	402	603
III. LAHORE DIV.	144	135	145	168	206	231	280	426	87	195	282	165	184	268	397	444	631
9. LHR	154	154	174	210	262	329	430	654	175	325	500	159	176	234	641	692	997
10. SLT	218	202	204	229	277	275	298	438	57	163	220	234	251	366	407	391	585
11. GWA	124	101	104	123	152	175	216	344	51	169	220	134	159	245	305	370	550
12. SHA	88	91	106	117	143	155	181	278	67	123	190	141	158	237	267	320	408
IV. MULTAN DIV.	33	37	41	51	65	83	103	149	50	66	116	73	87	125	256	286	319
13. MTN	48	55	60	80	102	145	185	275	97	130	227	121	146	214	245	286	366
14. SWL	39	44	63	91	121	166	195	259	127	93	220	152	173	224	262	301	334
15. MZG	36	39	39	41	49	52	68	108	16	56	72	48	63	99	303	262	240
16. DGK	20	22	20	21	26	26	32	47	6	21	27	23	28	41	229	281	289
V. BAHWALPUR DIV.	16	17	17	22	29	40	51	78	24	38	62	36	49	65	179	225	270
17. BWP	8	9	9	11	16	21	30	43	13	22	35	18	24	34	NA	277	350
18. BWN	28	30	30	38	52	71	93	121	43	50	93	65	81	102	NA	185	217
19. RYK	22	24	24	30	41	56	85	118	34	62	96	52	76	101	NA	235	273
PUNJAB	50	54	57	68	84	101	124	183	51	82	133	83	98	138	262	291	379
PAKISTAN	21	24	27	30	36	42	54	82	21	40	61	35	42	61	289	323	455

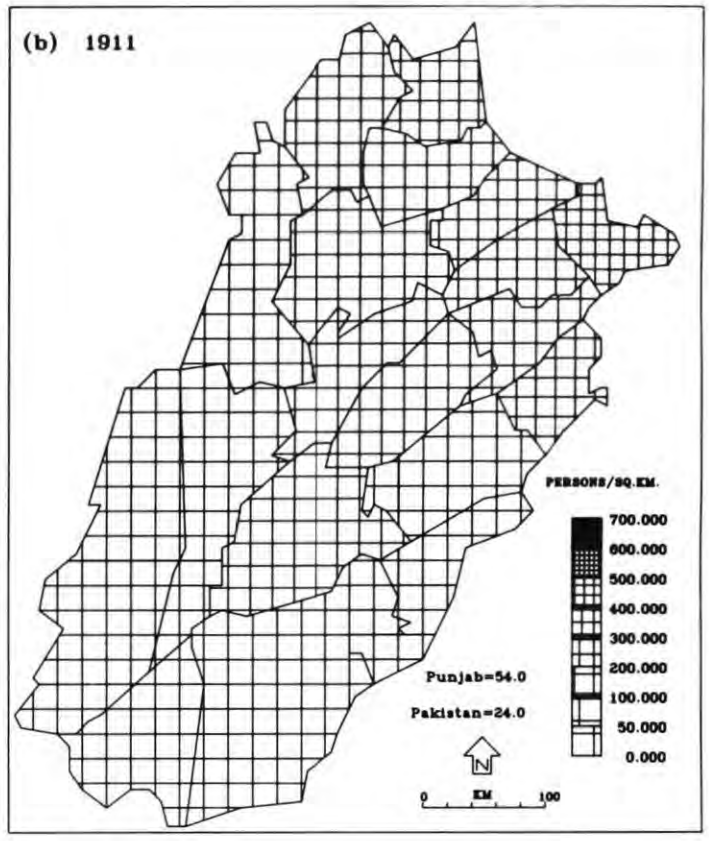
(1) Rural population per sq.km. of total area NA : Not available

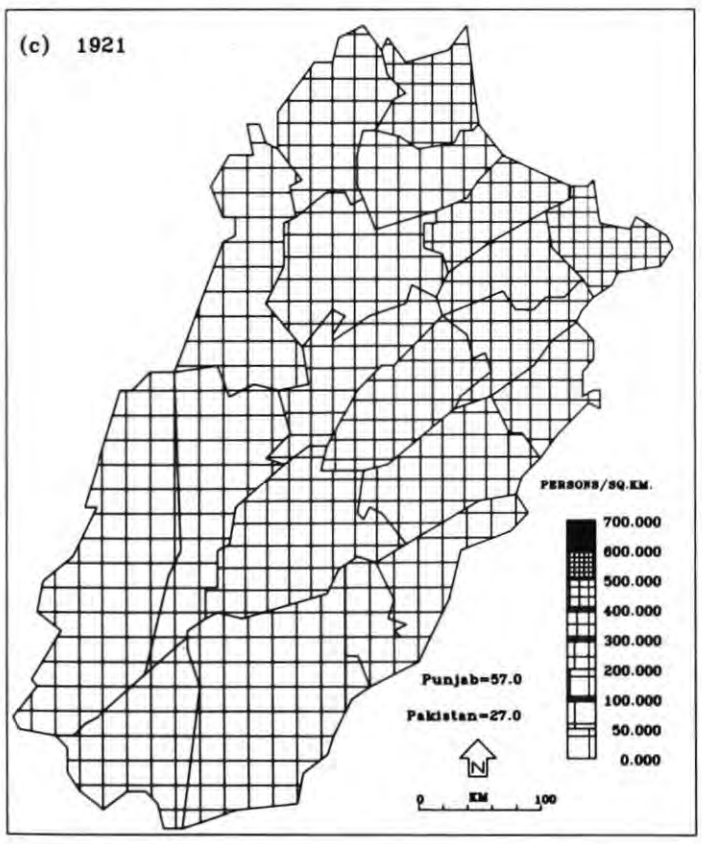
(2) Total population per sq.km. of net sown area

SOURCES: As in Table 4.5

FIG 4.6
POPULATION DENSITY IN THE PUNJAB
BY DISTRICTS, 1901-72







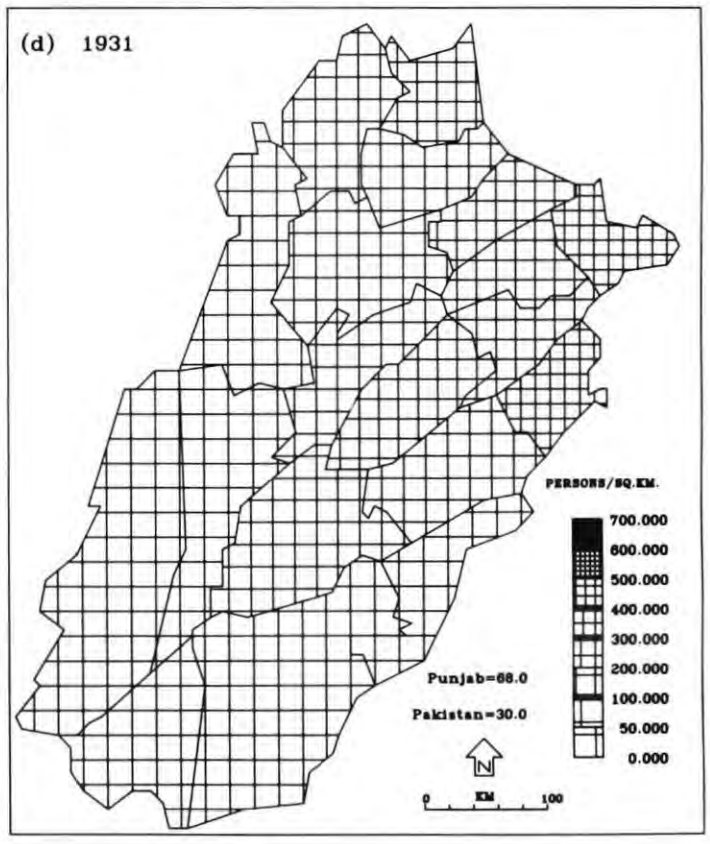
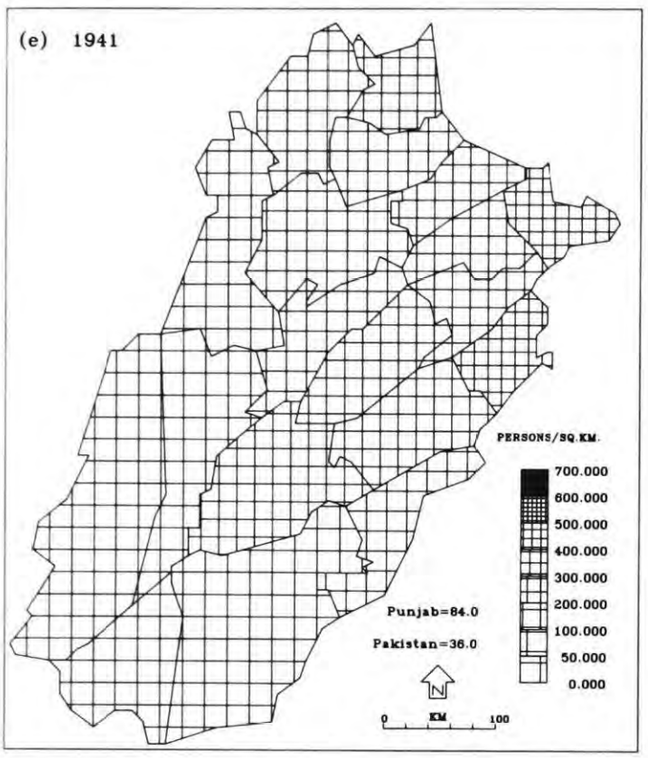
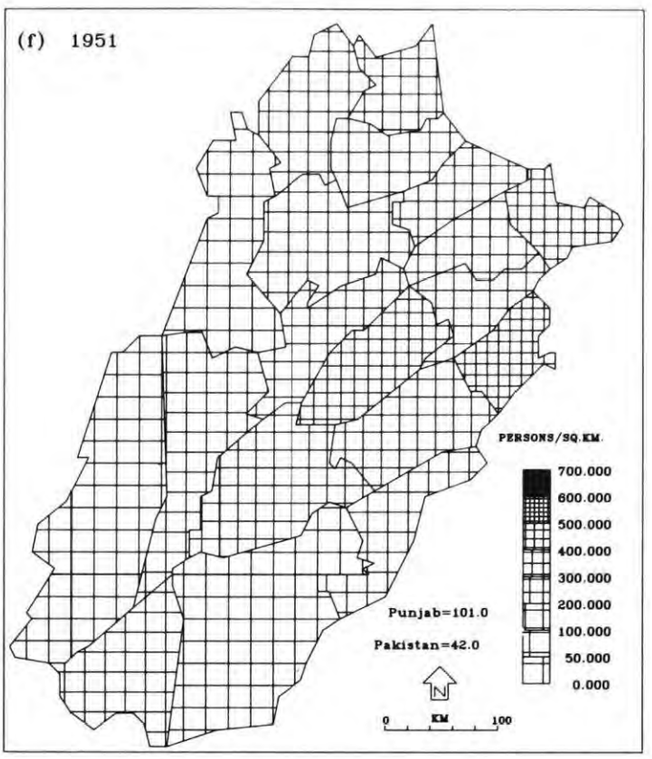
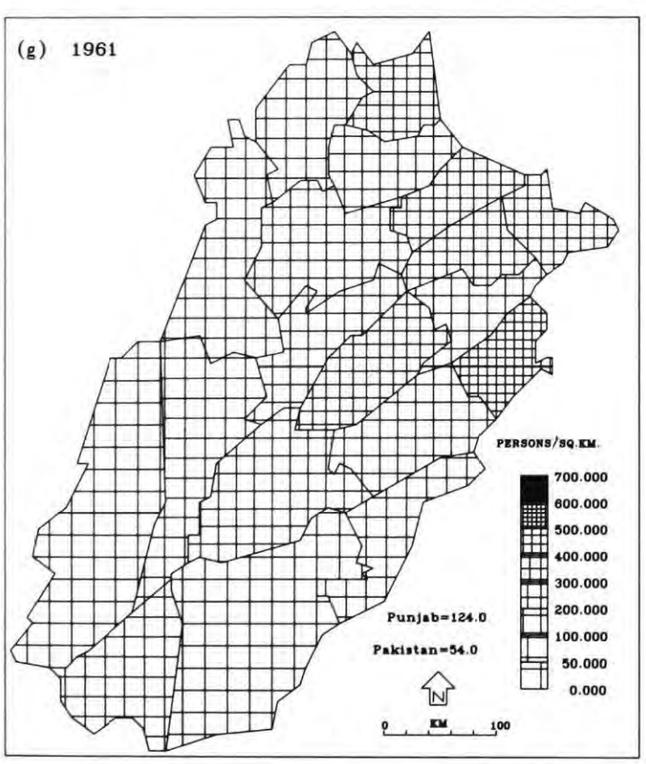
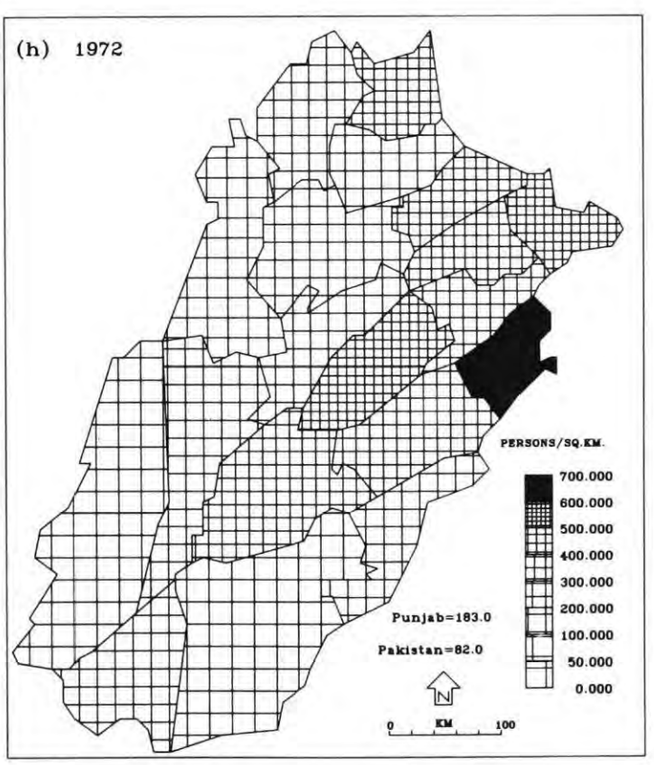


FIG 4·6 (contd)


(e) 1941
PERSONS/SQ.KM.
700.000
600.000
500.000
400.000
300.000
200.000
100.000
50.000
0.000
Punjab=84.0
Pakistan=36.0
N
0 KM 100


(f) 1951
PERSONS/SQ.KM.
700.000
600.000
500.000
400.000
300.000
200.000
100.000
50.000
0.000
Punjab=101.0
Pakistan=42.0
N
0 KM 100


(g) 1961
PERSONS/SQ.KM.
700.000
600.000
500.000
400.000
300.000
200.000
100.000
50.000
0.000
Punjab=124.0
Pakistan=54.0
N
0 KM 100


(h) 1972
PERSONS/SQ.KM.
700.000
600.000
500.000
400.000
300.000
200.000
100.000
50.000
0.000
Punjab=183.0
Pakistan=82.0
N
0 KM 100

district with population density above 200 per sq.km, while in 1972 nine district densities exceeded this figure. Similarly,in 1901 eight districts had their densities above the Provincial average while in 1951 this number had increased to nine and in 1972 to ten.

A broader and clearer picture of the variation of population density with respect to time can be obtained at the "micro" level of tehsils. It was found that the number of tehsils with a higher arithmetic density than that of the Province as a whole was 45, 44 and 42 in 1951, 1961 and 1972 respectively. In the case of rural density, the number was 50, 47 and 45 in these years respectively.

Table 4.14 points out the number of tehsils falling, in 1951, 1961 and 1972, within each of the six density classes discussed in Section 4.3.3. The distribution according to rural density is also given for the same classes. It is interesting to note that in 1951 seventeen tehsils fell within the lowest class of the arithmetic density (1-50 per sq.km),whereas in 1972 this number had dropped to 2. The drop in terms of rural density, on the other hand, was 17 to 5. Correspondingly, the number of tehsils with arithmetic densities of 400+ rose from 2 in 1951 to 10 in 1972 (Table 4.14).

The changes in population density of tehsils for the period 1951-72 are mapped in Figure 4.7. As is obvious, the highest rise in the arithmetic density during this period was recorded by Lahore (820 per sq.km), primarily due to the tehsil's rapid urbanization. Lahore tehsil experienced a rise of 155.9 per cent in its urban population between 1951 and 1972 and its level of urbanization mounted from 75.7 to 85 per cent during this period. The next tehsil with the highest change in population density was Lyallpur (500 per sq. km). Here again, rapid urbanization was responsible for this momentous rise. Lyallpur tehsil's urban population climbed by 348.5 per cent from 1951 to 1972 and its level of urbanization from 26.7 to 49.2 per cent. But rural population growth also played a major role in the case of Lyallpur's mounting population

TABLE 4.14

DISTRIBUTION OF TEHSILS ACCORDING TO POPULATION DENSITY CLASSES, 1951-72

Number of Tehsils

Density class (per sq. km)	Arith. Density			Rural Density		
	1951	1961	1972	1951	1961	1972
1 - 50	17	8	2	17	13	5
51 - 100	11	17	14	17	13	16
101 - 200	30	27	20	29	33	23
201 - 400	13	17	27	10	14	25
401 - 800	2	3	8	-	-	4
801 - 1,600	-	1	2	-	-	-
TOTAL	73	73	73	73	73	73

SOURCE : Computed by the author

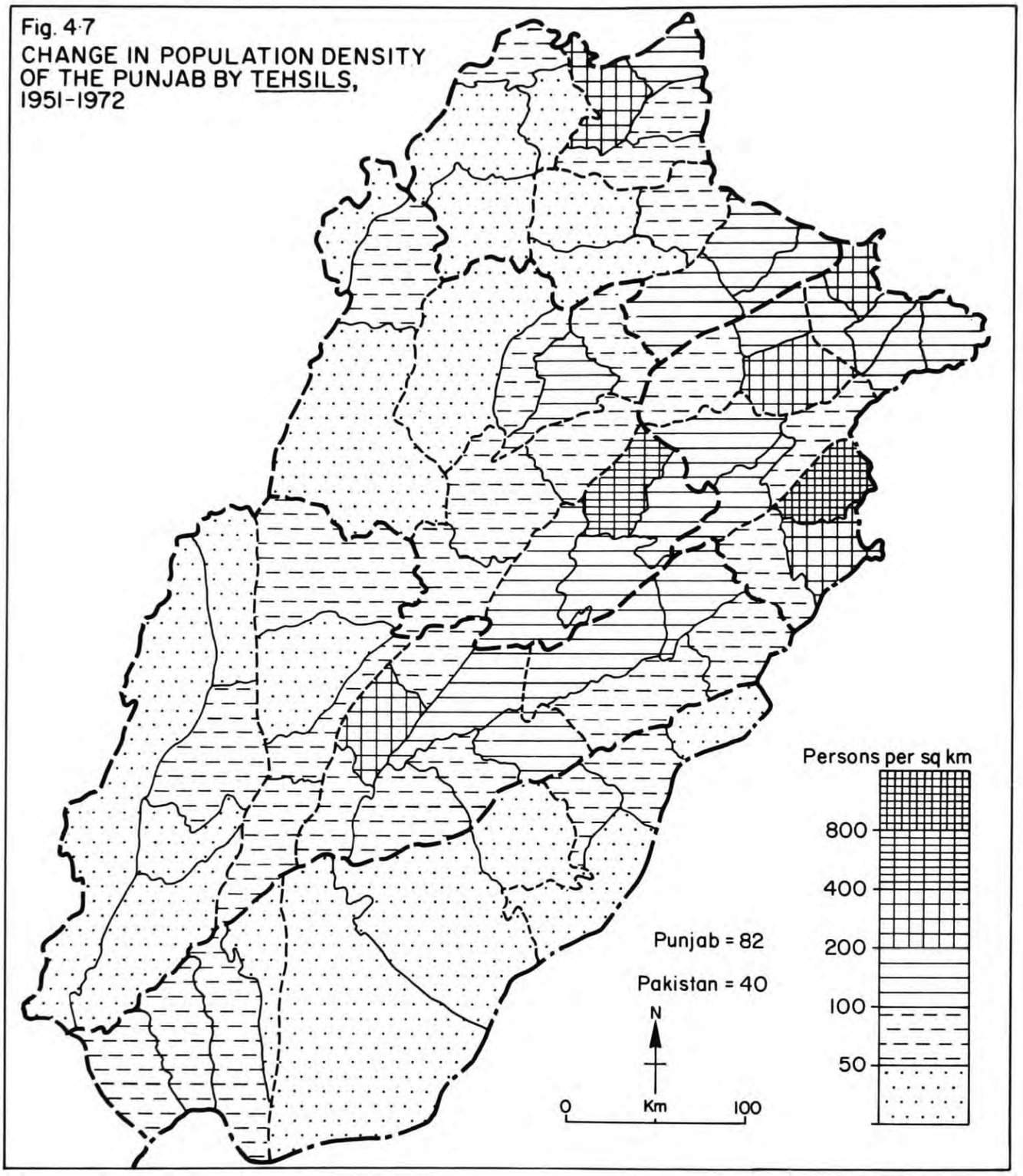


Fig. 4·7
CHANGE IN POPULATION DENSITY
OF THE PUNJAB BY TEHSILS,
1951-1972
Persons per sq km
800
400
200
100
50
Punjab = 82
Pakistan = 40
N
0
Km
100

density. The tehsil's rural density during the same period rose from 257 to 431 per sq.km.

Following Lahore and Multan, there are five tehsils which experienced increases between 201 and 400 in their population densities during the period in question, Multan (314 per sq.km), Kasur (306), Gujranwala (275), Rawalpindi (260) and Sialkot (225). In Multan and Gujranwala, this change was caused by the rapid growth of urban as well as rural population, while in Kasur and Sialkot where the level of urbanization actually declined during the period in question, the changes in population density were obviously propelled by a sharp growth of rural population, linked with agricultural expansion. In Rawalpindi tehsil, however, rapid urbanization was the main contributor to the density change. The tehsil's urban population grew by 167.5 per cent, raising the level of urbanization from 56.9 to 72.7 per cent between 1951 and 1972. Thus, whereas its rural density rose from 103 to 136, the arithmetic density climbed from 238 to 498 per sq. km. during this period.

Nineteen tehsils, all but one situated in the Chaj, Rechna and Bari doabs, experienced density changes between 100 and 200 per sq. km. Their rural population growth linked with a marked degree of agricultural expansion has been the prime determinant of this change. At the lower end of the scale, 47 tehsils recorded density changes below 100 per sq. km. during the period 1951-72, 19 of them less than 50 per sq.km. (Fig. 4.7). Most of them are situated in the Sind Sagar Doab and the Potwar area as well as in the trans-Indus and trans-Sutlej tracts, with a fast agricultural expansion. But, although population in some of these tehsils is growing sharply, the absolute density change so far has been rather low, mainly because of a late start of economic change as well as very low population density in these tehsils in the base year (1951).

4.4.5. Dynamics of Change

The patterns of population distribution in an area experience a change as the physical geography of the area is changed,either through natural processes

or by human action, or with changes in the character of the economy. (23) As the physical set-up of an area alters very slowly, often imperceptibly, the change in the distributional pattern of population is more closely linked with the nature and degree of resource exploitation as well as the vehicles of economic change particularly the technological developments.

In the Punjab, the mounting urbanization notwithstanding, the arithmetic density map has a great similarity to that of the rural density. Thus, although rapid urbanization with its stimulus for population redistribution has greatly modified the patterns of rural population distribution, particularly since 1947, the rural population size of various areal units has remained a principal determinant of overall population distribution and change. That, in turn, is closely linked with the agricultural potential and prosperity of the areal units. Even the pace and level of urbanization has a close association with the agricultural performance of the area (Section 3.7). Thus, the higher the agricultural prosperity of a region, the higher is its rural as well as arithmetic density.

In an arid and semi-arid region like the Punjab, where rainfall is meagre and erratic, the importance of water as a resource and of modern irrigation as a technology can hardly be overemphasized. The Punjab's vast alluvial plain has a high potential fertility for various crops. Thus agriculture has been the predominant activity in the region since ancient times. However, aridity linked with the inadequacy and uncertainty of rainfall has been a severe constraint for a more productive agriculture. Water is thus not only the life-blood of the people but an invaluable agricultural resource as essential as land, and the Punjab is fortunately well supplied with it through its perennial rivers.

Induced by the vagaries of dry climate, irrigation has been in vogue for centuries, dating back some 3000 years. (24) However, the modern perennial canal system, which laid down the basis of the present-day economy, started to take shape in the last quarter of the nineteenth century (Section 2.6).

Before the introduction of modern irrigation technology, a large part of the Punjab, with some of the ugliest and dreariest tracts in the world, consisted of rolling sand dunes patched with grass, and of hard unfruitful plains glistening with salt. (25) Population was sparse and the cultivation was carried on largely in the vicinity of the rivers. Level of urbanization was very low and the region was devoid of industries.

> "Greater portion of the Punjab consisted of arid waste with a rainfall which varied from 5 to 15 inches and this desert area was sparsely populated by nomad tribes of camel and sheep graziers". (26)

Further, caused by the erratic monsoons, the area was peculiarly susceptible to famines whose severity was enhanced by the lack of transportation facilities and means of communication as well as by a population that pressed too heavily upon the available land for subsistence. (27)

As the network of canals was constructed, the desert wasteland became suitable for crop production. Whereas the role of earlier modes of irrigation was limited in extent and scope, the perennial canal system paved the way for an extension of the cultivable area and consequently for broadening the Province's food base. In time, numerous irrigation schemes were completed and various canal colonies established. Being productive and attractive agricultural tracts, these colonies were rapidly filled by the farmers most of whom in-migrated from relatively congested parts of the Province. As a result, agriculture flourished and the overall economic performance of the region improved tremendously. Thus, once the poorest province in the subcontinent, the Punjab became the richest.(28)

The introduction and expansion of large perennial irrigation schemes set in train a process of large scale population redistribution. Certainly without the "miracle" of irrigation technology the Province could not have witnessed a revolutionary change in its economic base. The colonization of vast tracts in the Punjab was indeed a unique phenomenon and as Mason (1954) has remarked :

> "If the English were to choose one monument by which their years in India were to be remembered, it might well be the canals, the cotton and the prosperous villages of Lyallpur". (29)

This was, however, just one of the Punjab's colonies and there were several others. Although some irrigation development had taken place in the Province soon after its annexation by the British in 1849, rapid expansion of irrigation and the resulting massive colonization did not begin until 1882. Between 1882 and 1947, nine irrigation schemes were completed involving irrigation and colonization of some 5 million ha. of previously unproductive barren land. (30)

The changed economic situation in the Province as a result of these schemes can be judged by the fact that between 1868 and 1931 the population of British Punjab increased by 49.3 per cent while the cultivated area rose by 50 per cent (Table 2.6). The cultivated area per capita increased from 0.51 ha. in 1868 to 0.53 in 1931. The share of canal irrigated area in the total cultivated rose from 6.8 per cent in 1868 to 41 in 1931. Beside canal construction, the lack of transportation facilities was also remedied in due course by building roads and railways. This obviously resulted in economic prosperity as well as in offsetting the famine hazard.

> "The development of transportation facilities, railway, canals and highways shares with the steady expansion of irrigation canal the honor of changing the Punjab from a constantly famine-endangered province to one which is practically secure from such visitations". (31)

The change in the economic situation in turn impelled a change in the areal patterning of population distribution. The flow of human tide to the canal colonized "pull" areas and the resulting change in the pattern of the Province's population distribution is reflected by their rising population densities. Between 1881 and 1901, irrigation and colonization schemes were introduced in the Bari and Rechna <u>doabs</u> which benefitted Lahore, Sahiwal, Multan, Sheikhupura and Lyallpur. In 1881, these districts had population densities of 114, 30, 37, 59 and 6 per sq.km. respectively, which had increased to 154, 39, 48, 88 and 64 respectively by 1901. The irrigation schemes covered relatively smaller areas in the Bari Doab, which accounts for a meagre change in the

densities of Multan and Sahiwal. However, the Lower Chenab Colony Scheme (1892-96) to cover the Rechna Doab was designed to irrigate a vast tract of hitherto unproductive wasteland. Its effectiveness can be judged from the fact that, between 1891 and 1901, the districts of Lyallpur and Sheikhupura together received 443,700 in-migrants and the number rose to 579,600 in the following decade. (32) As a result, Sheikhupura's population density rose from 59 to 88 per sq.km. between 1881 and 1901. However, the most conspicuous case is that of Lyallpur which experienced a massive change in its population size and density as a result of canal colonization. In 1881, the district's population density was 6 per sq.km, by 1901 it had jumped to 64.

Between 1901 and 1921, the completed irrigation projects provided water to Sargodha and Jhang districts in the Chaj Doab; and to Sahiwal and Multan in the Bari Doab. As a result, the district densities rose from 39 to 58 in Sargodha, 48 to 65 in Jhang, 39 to 63 in Sahiwal and 48 to 60 per sq. km. in Multan during this period (Table 4.13).

By 1921, numerous changes in the economy introduced by the British began to show their results. Consolidation and improvement of irrigation schemes, continued enlargement of the irrigated and cultivated area, considerable improvement in transport, hygiene and sanitary facilities, and elimination of famines, all combined to boost the Province's population growth. The importance and effectiveness of the irrigation-cum-colonization schemes did not decline however with the progress made in other aspects of the economy.

During the period 1921-41, the Sutlej Valley and the Haveli projects were completed. In addition, the Triple Canal Project, completed between 1910 and 1915, started functioning with greater efficiency. Thus, whereas the prosperity of the already colonized districts continued to increase, new lands were opened in the Bahawalpur division; and in the districts of Sahiwal and Multan where additional quantities of water were provided for the already irrigated areas. As a result, the population density increased from

60 to 102 per sq. km. in Multan district, 63 to 121 in Sahiwal and 17 to 29 in the Bahawalpur division between 1921 and 1941 (Table 4.13).

The trend of rising population density in relation to the process of colonization continued after 1941, particularly in the post-Independence period. As a result of the Jinnah and Taunsa projects, for example, the population densities have doubled in the districts of Muzaffargarh and Mianwali and nearly doubled in Dera Ghazi Khan between 1951 and 1972. In addition, the districts where irrigation was introduced in previous decades experienced a high rate of population growth, mainly as a result of the improved and extended irrigation and also because of an interplay of other economic factors. Their population densities, therefore, continued rising sharply. Sahiwal increased its density from 121 to 259 per sq.km. during the period 1941-72, Multan from 102 to 275 and Lyallpur from 153 to 466. A somewhat similar situation was experienced by the other canal colony districts : Sargodha, Sheikhupura,Bahawalpur, Bahawalnagar and Rahimyar Khan(Table 4.13).

In addition to famine prevention, improvement of the economy and raising the living standard, the British Government envisaged relieving, through its irrigation schemes, the pressure on the soil in some of the Province's more densely peopled districts. (33) As already mentioned, the modern irrigation era in the Punjab commenced in 1882. Population densities in the various districts of the Province from 1881 to 1941 will, therefore, show to what extent the intent to relieve population pressure was fulfilled.

Table 4.15 presents population densities of two categories of districts, the densely populated eastern districts, some of which are outside the present study area; and the sparsely populated western districts. It is evident that, during the two decades between 1901 and 1921, irrigation expansion in the western districts proved effective in reducing the population pressure in the eastern districts. This is reflected in the decline of population densities in the eastern districts and the corresponding rise in the canal colony

TABLE 4.15 POPULATION DENSITY IN SELECTED DISTRICTS OF THE UNDIVIDED (BRITISH) PUNJAB, 1881-1941

Densely Populated Eastern Districts	Density/km^2				Sparsely Populated Western Districts	Density/km^2			
District	1881	1901	1921	1941	District	1881	1901	1921	1941
1. Jullundur*	231	268	240	326	1. Sargodha	31	39	58	81
2. Amritsar*	219	251	228	347	2. Mianwali	19	22	26	36
3. Sialkot	206	218	204	277	3. Jhang	44	48	65	93
4. Gurdaspur*	172	197	178	241	4. Lyallpur	6	64	106	153
5. Ludhiana*	171	186	157	226	5. Sheikhupura	59	88	106	143
6. Ambala*	171	168	140	171	6. Multan	37	48	60	102
7. Hoshiarpur*	160	176	164	206	7. Sahiwal	30	39	63	121
					8. Muzaffargarh	31	36	39	49
					9. Dera Ghazi Khan	16	20	20	26
					10. Bahwalpur (Division)	14	16	17	29

* Now in India

SOURCES : computed from 1. Census of India 1881, 1901, 1921, 1931, 1941(5 vols)
2. District Census Reports 1972 (19 vols)

western districts. However, in the later decades the difference of densities in these categories was evened out. This means that population in the eastern districts started growing at a higher rate than in the western districts and reduction in population pressure by way of irrigation development proved to be temporary.

4.5. SUMMARY AND CONCLUSION

From the account given in this chapter, it is clear that the patterns of population distribution and density in the Punjab are the product of an interplay between a variety of elements, physical and human. Although arithmetic density is considerably increased, in some parts, by a high level of urbanization, a map of overall density has, generally speaking, a close resemblance with that of rural density.

With 76 per cent of its people living in villages and 55 per cent of the work force employed in agriculture, the Province has a predominantly agro-rural economy. The areal patterning of population concentration is, therefore, primarily influenced by the agricultural resources, and the population density of a district is closely linked with its agricultural and food producing capacity. This is supported by the high positive coefficients of correlation between these variables.

Agricultural performance is, in turn, influenced by the extent of cultivable area and the water availability. In its arid and semi-arid conditions, the availability of water carries enormous significance for the exploitation of the region's agricultural resources, and development of modern irrigation during the British period provided this necessary but hitherto lacking ingredient. This brought about a revolution which gave new dimensions to the region's economic base. With the rapid development and expansion of irrigation, the patterns of population distribution and density underwent an enormous change. It has been proved through an analysis that population size of a district carries a high positive correlation with the size of irrigated area. The

availability of water helps in a profitable exploitation of the intrinsic fertility of the alluvial soil and thus bears a high positive correlation with the food production which, in turn, influences the population concentration in a district.

The changes in the patterns of population distribution and density in the Province during the period 1881-1972 bear ample testimony to the effectiveness of introducing water in an arid area. The densities of the districts,where irrigation facilities were provided, climbed quickly while those of the non-irrigated districts increased at a much slower rate.

REFERENCES AND NOTES (IV)

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2. As explained in Table 3.5, the intercensal rate of change between 1961 and 1972 will be 41.4 per cent if allowance for 7.5 per cent under-enumeration in the 1961 census population is made.
3. Housing Economic and Demographic Survey 1973
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CHAPTER V

PATTERNS OF AGRICULTURAL CHANGE

5.1. INTRODUCTION

Having obtained a fairly comprehensive insight of population change in the Punjab, we now examine the level and trends of the changes in the region's economy with emphasis on its agricultural sector.

As explained in Section 1.6, the data for this analysis were obtained from the region's regular agricultural publications. During the post-Independence period, Pakistan had two agricultural censuses in 1960 and 1972 which provide invaluable information about the country's agricultural conditions. In the present inquiry, relevant volumes of these censuses have been utilized. However, the great bulk of the agricultural data in the present analysis was drawn from the Punjab's regular "Season and Crop Reports" brought out annually by the Provincial Agricultural Department. In order to draw comparisons between the Punjab and Pakistan's other provinces, however, recourse was made to the periodic publications of the Federal Ministry of Food and Agriculture, particularly the "Agricultural Statistics of Pakistan", which make available reliable statistics regarding agricultural inputs and outputs for the whole country as well as for its provinces during the post-1947 period. A comparison between the data obtained from these two sources revealed a number of discrepancies. These were , nonetheless, very small compared with the total mass of data and thus did not present any serious obstacle to the analysis as a whole. Any supplementary data in the course of investigation were drawn from various other periodic and regular statistical sources, such as the "Statistical Yearbooks" and "Economic Surveys".

As stated at the outset, a major objective of this study is to explore the relationships between the Punjab's population growth and its agricultural change. Since the values of agricultural variables suffer, under normal circumstances, from wider annual fluctuations than do those of population variables, the need was to have some "stable" figure for comparison between the

two sets of variables. Thus, in the case of agricultural statistics, five-yearly averages were taken for the periods 1948-9/1952-3, 1958-9/1962-3 and 1970-1/1974-5, providing material for comparisons with the population data of the 1951, 1961 and 1972 censuses respectively.

A problem faced in the processing of agricultural data was that in Pakistan the unit of agricultural area has traditionally been the acre, while that of production is maund. Although the metric system has now been adopted at official level, the data for the period of the present investigation are available only in old units. In order to make them comparable and up-to-date, the acres were converted into hectares at the rate of 2.47109 acres to a hectare; and maunds into tonnes at the rate of 26.791 maunds to a tonne; as prescribed in the FAO and the Government of Pakistan publications respectively.

5.2. A REVIEW OF PAKISTAN'S ECONOMIC PROGRESS

Like most Third World countries, Pakistan inherited at its independence a multitude of grave problems, the foremost being economic. It looked like a country simultaneously brought into being and disrupted by the subcontinent's partition. (1) The country's economy was severely underdeveloped, marked by the absence of major industries and an efficient commercial system. Due to historical, political, economic and strategic factors, the commercial and industrial activities had concentrated in the subcontinent's eastern and southern parts and the areas that composed Pakistan had remained predominantly agricultural and economically most backward.

The Partition placed Pakistan at a grave disadvantage since all major manufacturing areas fell on the other side of the new frontiers. In agriculture, although Pakistan received some of the world's best irrigated cropland, the agricultural potential was overall divided unfavourably. The newly drawn border not only split the Punjab - the "granary of the subcontinent" - into two, but also separated its important irrigation network in Pakistan from the canal

TABLE 5.1 PAKISTAN'S SHARE OF THE PRE-INDEPENDENCE SUBCONTINENT'S RESOURCES

Category and Item	Unit of Measure	Pre-Independence Subcontinent's Total	Pakistan's Share	
			Quantity	Per cent
AGRICULTURE				
Total Cropped Area	mill ha	103.8	11.6	11.1
Net Sown Area	"	87.9	10.7	12.1
Current Fallow	"	78.9	4.0	5.1
Irrigated Area	"	24.1	8.7	36.1
Wheat Area	"	14.2	3.9	27.5
Rice Area	"	32.7	0.8	2.4
Cotton Area	"	3.8	1.3	34.2
Sugarcane Area	"	1.4	0.1	7.1
Forest Area	"	26.5	1.3	4.9
Wheat Production	mill tonnes	9.1	3.2	35.2
Rice Production	"	27.1	0.7	2.6
Cotton Production	th. bales	35.0	14.0	40.0
MINERALS				
Chromite	th. tonnes	36.6	17.3*	47.3
Coal	mill tonnes	25.2	0.33*	1.3
Iron	"	2.4	0.001*	-
Oil	mill litres	459.6	157.3 *	34.2
Sulphur	th. tonnes	12.2	12.2 *	100.0
Salt	mill tonnes	193.0	50.8 *	26.3
INDUSTRIES				
Sugar Mills	Numbers	150	3 *	2.0
Textile Mills	"	1,542	46 *	0.03
Paper Mills	"	15	NIL	NIL
Iron & Steel Mills	"	18	NIL	NIL
Engineering Plants	"	420	42 *	10.0
Other Plants	"	13,188	1,414 *	11.0
Industrial Labour	millions	3.1	0.2 *	6.5

* Data are for the pre-1972 Pakistan, so could be even less for the present Pakistan

SOURCES : 1. Tayyeb (1966)

2. Agricultural Statistics of Pakistan 1975

headworks in India, especially on the Ravi and Sutlej. It also endangered the others, since those rivers flowed through the Indian and the Indian held Kashmir territory before entering Pakistan. Table 5.1 presents a vivid picture of some of the economic disparities between the two countries at the time of Partition.

As is evident, although in the agricultural sector conditions were somewhat better, in industries Pakistan trailed far behind India. It is interesting to note that, although Pakistan grew almost two fifths of the subcontinent's cotton, it possessed no cotton textile mills. In minerals, Pakistan's heritage was less poor than in manufacturing but due to a generally poor quality of coal and iron ore, they could contribute less than 0.4 per cent to the country's GNP.

The banking and insurance departments and the government offices dealing with fiscal and economic matters, which were manned mainly by Hindus and Sikhs, were paralysed by their departure. Further, the rural credit system which had been entirely in the hands of a class of moneylenders - the Hindu bunyas - was disrupted due to their flight. In addition, the withdrawal of assets by the non-Muslim bankers and business community exerted enormous pressure on the country's already tenuous resources.

The effects of economic upheaval were aggravated by a massive and spontaneous, unplanned and unprecedented, two-way flow of population over the new borders. It is estimated that Pakistan received over six million muhajirs within a few months after Partition,[2] almost all of them empty handed and an overwhelming majority consisting of farmers and craftsmen. This large scale unplanned transfer of population exacerbated the new country's already serious problems.

Pakistan's initial difficulties were also worsened by the antagonistic Indian policy characterized by the stoppage of canal waters, occupation of Kashmir and a strong resentment of Pakistan's refusal to devalue its currency

culminating in a trade boycott. Thus, the economic "pundits" all over the world were rather pessimistic about Pakistan's survival in its early years. One of the poorest countries in the world, it was regarded an "economic wreck" (3), even an "economic monstrosity".(4)

But within a year of the independence, a spectacular change started taking shape. According to Myrdal (1968):

> "Born in communal strife and political and economic chaos and bordered by hostile neighbours, the country's survival as a political unit was remarkable." (5)

In due course the country's economic climate started to improve. The damage caused by Partition to economic infrastructure and government machinery was repaired and the vacuum in various occupations caused by wholesale migration was gradually filled. The banking system was restored with the establishment, in July 1948, of the State Bank of Pakistan. Power, transport, communications and municipal facilities were revivified and then developed at a fast rate. The economy received a tremendous boost with the Korean war in 1950-1, when Pakistan's earnings from raw material exports climbed sharply.

The end of the Korean boom, however, brought about a period of severe strain with a sharp decline in trade and foreign exchange. At the same time, political instability entered the national scene. In addition, although industries continued making brisk advances, the agrarian problems became difficult. As a result, Pakistan, which had been a surplus food producer in 1951-2, became a large scale food grain importer in the following years. Inability to solve agrarian and especially food problems, lack of foreign exchange, and above all, political instability combined to create economic chaos. Consequently, the country plunged, at the end of 1952, into a period of difficulty characterized by an apparently stagnant economy and increasing economic problems. (6)

Recovery began at the end of 1958, when political stability was restored under Ayub Khan. Despite a number of set-backs,including the disruption of

aid from the United States and other Western nations, the country continued to make economic progress during Ayub Khan's regime (1958-69). For quite some time during the 1960's, the rate of economic growth was much higher than that of population increase. In the words of Papanek (1967):

> "Prophets of gloom and doom were disappointed by radical economic changes which began in the late 1950's. By the middle 1960's the rate of economic growth was more than double the rate of population growth; investment was approaching a healthy 20 per cent, and savings exceeded 10 per cent of domestic resources ------ In the face of its pitiful resource and capital endowment at independence, and in comparison with other countries, Pakistan's performance was outstanding." (7)

This marked improvement in the country's economic health won praise from many foreign observers. According to the New York Times:

> "Pakistan may be on its way toward an economic milestone that so far has been reached by only one other populous country, the United States." (8)

The Times (London) commented :

> "The survival and development of Pakistan is one of the most remarkable examples of state and nation building in the post-war world." (9)

As in a few other Third World countries, the main vehicle of Pakistan's economic improvement was its series of economic plans. Despite its preoccupation with the gigantic problems resulting from Partition, the government paid due attention to rebuilding the national economy. Within the first year of Independence, a Development Board was established whose function was to coordinate development plans devised by the provincial governments and to watch and report on the progress made by various development projects. It was followed by the creation, in 1949, of the Ministry of Economic Affairs with the responsibility of coordinating the planning and economic activity of the various ministries. The Development Board at the same time made an attempt at comprehensive planning by putting together a six year (1951-7) development plan in 1950, in line with the recommendations of the Colombo Plan Consultative Committee. This proved in many ways to be a flexible plan and, during its first

five years, the actual expenditure was Rs.3,000 million against the Plan allocation of Rs.2,600 million. (10) Agriculture received about one third of the total allocation and power, industry and transport each received between 18 and 20 per cent.

During the period 1950-55, Pakistan's industrial production registered a considerable increase from a modest beginning and rose, in value added terms, by 65.7 per cent from Rs.1,042 million to Rs.1,727 million. Thus the share of the manufacturing sector in the GNP increased from 8.1 to 11.5 per cent. But the agricultural sector, the mainstay of the country's economy, trailed behind and, despite a government organized "Grow More Food" campaign, the production of foodgrains declined by 15 per cent, from 6 million tonnes in 1950-1 to 5.1 million in 1954-5. In the Punjab, the country's principal food producing province, the decline in foodgrain production was sharper - 20.8 per cent. Not only the total production fell but the areas and yields of these crops also declined. The productivity per hectare of wheat, for instance, fell during the period in question by 23.6 per cent in the Punjab and by 22.2 per cent in the country as a whole. However, the production and yields of cash crops - cotton, sugarcane and tobacco - showed marked increases.

The recession at the end of the Korean war in 1952 had given a rude jolt to the country's fragile economy, when the prices of Pakistan's exports had declined precipitously and those of its imports mounted sharply. Hence, while the Six Year Development Plan was being implemented, a strong need was felt for a systematically planned approach towards the country's problems. Thus, with a view to formulating a coordinated and integrated development plan based on a proper assessment of the country's resources, the National Planning Board was established in July 1953 which after the first few years of uncertainties and problems grew into an effective advisory body by October 1958 when it was raised to a Planning Commission.

Pakistan's economy entered the era of "Five Year Plans" in 1957. The

First Plan,which marked the first comprehensive, scientific and integrated approach to economic development in the country, was designed to cover the years 1955-60. However, it lost half of its life period awaiting government's approval, accorded finally in 1957. In the event it proved to be an over-ambitious programme and the per capita income rose by a mere 2.8 per cent compared with the planned 7 per cent. The total development expenditure amounted to Rs.10,590 million compared with the Plan outlay of Rs.10,800 million.

The objectives of the Plan were most fully achieved in the industrial sector where, although the increase of industrial production was nowhere in the region of the envisaged 60 per cent - the value added in manufacturing rose by 28.6 per cent - the implementation of the Plan helped in building the infrastructure which proved vital for a rapid growth in the following years. In addition, favourable exchange rates for imported capital goods, reduced tax rates and sensible economic policies affecting the private sector paved the way for a rapid industrial expansion.

In agriculture, the target was to increase the production of total foodgrains by 9 per cent and that of cash crops by 15 to 33 per cent. Between 1954-5 and 1959-60, Pakistan's total cultivated, cropped and irrigated areas rose by 7.8, 10.6 and 4 per cent respectively and the use of chemical fertilizer increased by 37.6 per cent. As a result, the total foodgrain production increased by 11.1 per cent and that of wheat by 13.3 per cent. However, the target of self-sufficiency in foodstuffs could not be reached and a large share of the country's foreign exchange and aid had to be spent on the purchase of food; imports of wheat increased more than six fold from 113,360 tonnes in 1955-6 to 816,605 in 1959-60.

The Second Five Year Plan (1960-65) envisaged an increase of 24 per cent in the national income, 12 per cent in per capita income, 21 per cent in foodgrain production and 60 per cent in industrial output. In addition, an increase of 3 per cent per year was anticipated in foreign exchange earnings.

The Plan was successful since most of its key targets were reached and some even exceeded. The actual increase in national income during the Plan period was 38.7 per cent and that in the per capita income 20.6 per cent. Agriculture, which had the highest priority in the Plan with the aim of self-sufficiency in foodgrain production, made good progress with an increase of 17.4, 35.8 and 21 per cent in the wheat, rice and total foodgrain production respectively. In addition, cotton and sugarcane, the country's principal cash crops, experienced an increase of 29.6 and 75 per cent in their production respectively. Industrial production, on the other hand, increased by 74.1 per cent and the foreign exchange earnings by 7 per cent.

Not only was the Second Plan successful in meeting the anticipated targets but it was also instrumental in the structural transformation of Pakistan's economy. The manufacturing sector, despite making great strides in the past, had remained low in its contribution to the GNP, but during the Second Plan period (1960-65), its share of GNP rose from 12 to 15.1 per cent and that of agriculture dropped correspondingly from 45.9 to 39.8 per cent. The increasing contribution of manufacturing and other non-agricultural sectors gave new dimensions to the country's economy.

The principal objective of the Third Five Year Plan (1965-70) was to move efficiently and speedily in the direction of a "welfare state". But it ran into difficulties soon after it was launched. The war with India in September 1965 resulted in diversion of domestic resources from development to defence; and suspension of foreign aid, mainly from the United States, cut off the vital, external financial support. This was followed by drought in 1965-6 and floods in 1966-7 which depressed agricultural performance considerably. As a result, the Plan was underspent by Rs.9,150 million or 17.6 per cent.

However, between 1964-5 and 1969-70, the GNP rose by 38.8 per cent against the Plan target of 37 per cent and the per capita income climbed by 20.4 per cent compared with the anticipated 20 per cent. The value added in agriculture and manufacturing rose by 35.6 and 47.6 per cent respectively, and

the production of foodgrains increased by 34.5 per cent against the Plan target of 27.8.

The Fourth Five Year Plan (1970-75), formulated with a view to maintaining the tempo of development through efficient utilization of existing resources, making the economy increasingly self-reliant in most essential fields and moving towards the establishment of a just society with efficiency and despatch, ran into difficulties at its very start. First, it was criticized on the grounds that it created a small privileged class at the expense of the masses, and later it lost its meaning with the separation of East Pakistan. Thus, instead of making an effort to recast the Plan for the present Pakistan, a series of Annual Development Programmes were initiated.

The Gross National Product declined by 0.1 per cent in 1970-1 and rose by only 1.4 per cent in 1971-2 due to the country's chaotic political climate. It rose by 7.4 per cent in 1972-3, 6.8 per cent in 1973-4, 2.1 per cent in 1974-5, 4.9 per cent in 1975-6, 2.8 per cent in 1976-7 and 9.2 per cent in 1977-8. In all, during the eight years between 1969-70 and 1977-8, the GNP rose by 39.6 per cent, the per capita income by 10.1 per cent and the value added in agriculture and manufacturing by 15.7 and 16.9 per cent respectively.

In 1978, a renewed effort at five-year planning was made when the Fifth Five Year Plan (1978-83) was announced. This envisages, inter alia, increases of 47.1 and 34.5 per cent, during the Plan period, in wheat and rice production respectively with a view to eliminating the need for food imports. As usual, the main focus of the Plan is the rapid development of agriculture based on an efficient utilization of the land, manpower and water resources and also an enhanced use of modern inputs.

According to the latest economic survey, Pakistan's economy has started, after a long difficult period of the 1970's, to show signs of improvement. During 1979-80, the country's Gross Domestic Product rose by 6.2 per cent, agricultural production by 6 per cent and industrial output by 8.1 per cent.

These rates were higher than the corresponding rates in 1978-9 : 5.9, 4.2 and 7.4 per cent respectively. (11)

In summary, Pakistan's national income increased at a slow rate of 3.1 per cent per annum between 1949-50 and 1959-60 when it barely exceeded the population growth rate (2.5 per cent). The period 1960-70 however experienced a striking change from near-stagnation to rapid expansion. As a result, the national income rose at an annual rate of 6.8 per cent between 1959-60 and 1969-70, considerably in excess of the population growth rate (3.6 per cent). During the 1970's, the economy slackened once again when the average growth rate of national income dropped to 4.2 per cent per annum between 1969-70 and 1977-8. The value added in agriculture experienced the average annual growth rates of 1.6, 5 and 1.8 per cent during the three periods in question while that in the manufacturing sector grew by 7.7, 9.9 and 2 per cent. The per capita income registered an average annual increase of 0.6 per cent between 1949-50 and 1959-60 and 3.8 per cent in the following decade. However, it dropped to 1.2 per cent between 1969-70 and 1978-9.

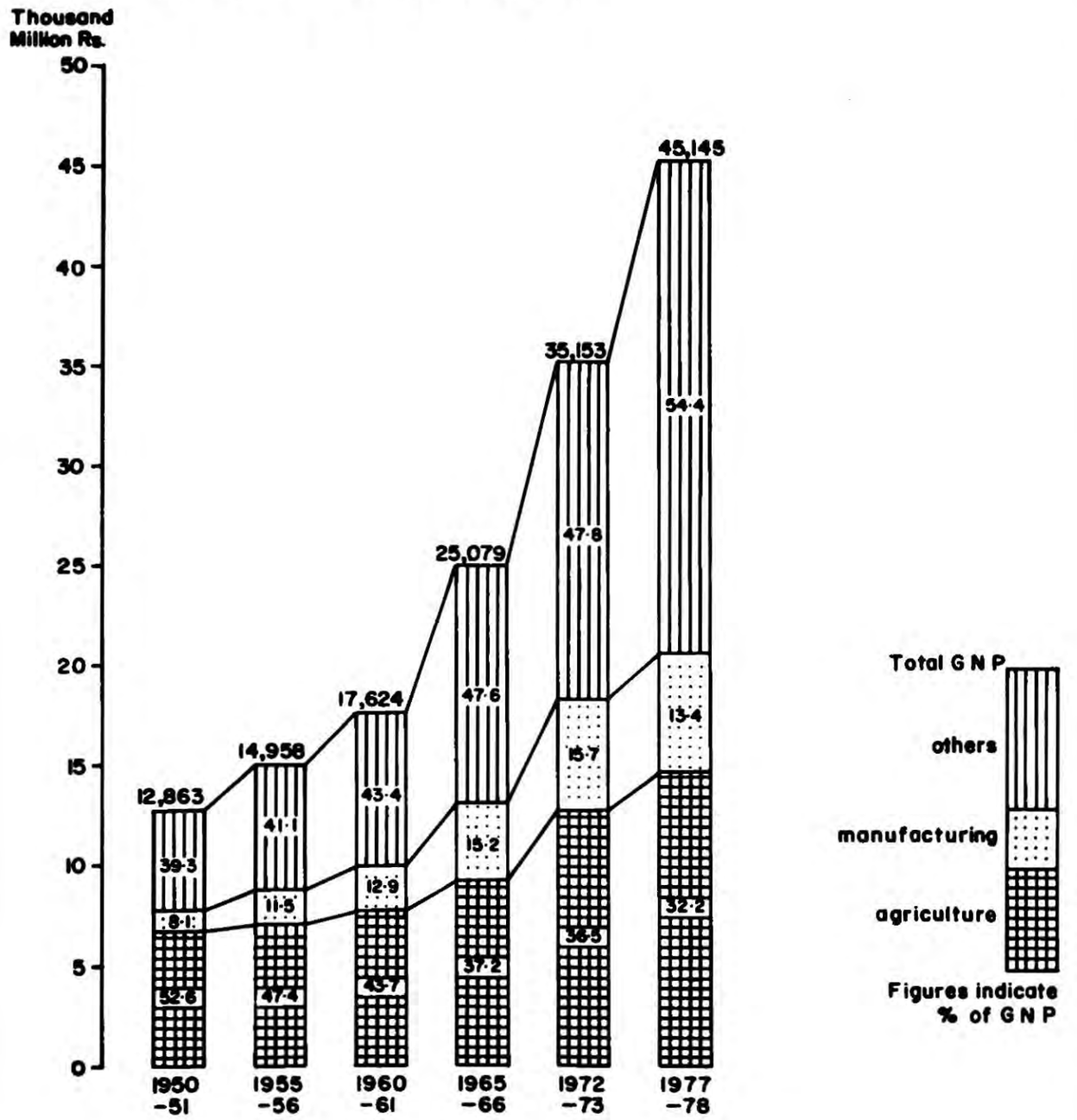
5.3. THE PLACE OF AGRICULTURE IN PAKISTAN'S ECONOMY

The composition of a country's Gross National Product provides a useful indicator of the relative importance of the various sectors of its economy. Figure 5.1 shows the changing pattern of Pakistan's economy in terms of the GNP and its constituent sectors during the post-Independence period, at the constant factor cost of 1959-60.

Despite a substantial structural transformation of Pakistan's economy during the last three decades, agriculture continues to occupy a prominent position. Its share in the GNP was 52.6 per cent in 1950-1 and, although it declined to 32.2 per cent in 1978-9, it is still the largest single contributor to the GNP. Not only that, about three fourths of the country's population living in rural areas depends on land for its livelihood.

Fig 5·1

COMPOSITION OF PAKISTAN'S GROSS NATIONAL PRODUCT, 1950-51 / 1977-78 (AT CONSTANT FACTOR COST OF 1959-60)



According to the Housing Economic and Demographic (HED) Survey 1973, 56.2 per cent of Pakistan's total labour force was employed in agriculture, the corresponding figures for the rural and urban labour force being 71.4 and 8.6 per cent respectively. Not only does agriculture provide jobs to an overwhelming portion of the population, it also meets, in normal circumstances, almost 92 per cent of the country's food requirements. (12) Further, besides providing raw materials for the country's chiefly agro-based industry, agriculture is the principal contributor to Pakistan's exports. In 1969-70, about one third of the country's foreign exchange came through the export of agricultural commodities and this share rose to 48 per cent in 1974-5. (13)

However, the continuing dominance of agriculture in the national economy is not a source of great optimism in a developing country. This is further underscored by the fact that agriculture's contribution to Pakistan's GNP is not as impressive as its role in employment, a fact reflected in the low overall per capita income. With 1.8 per cent of the world's population, Pakistan produces 1.9 per cent of the world's wheat, 4.5 per cent of its cotton and 3.9 per cent of its sugarcane (Table 5.2), but its per capita income (170 US $) is nowhere in the vicinity of the world's average (1650 US $) and is one of the lowest in the world (Table 4.1). The main reason for this situation is undoubtedly the extremely low productivity of its agricultural labour force.

Poverty in a society is not necessarily cured by increasing the average per capita income, though in an affluent society the per capita income is essentially high and is used as a yardstick for the prosperity of the nation as a whole. In fact, an affluent nation is economically developed and this is achieved mostly via the development of non-agricultural sectors. Since the per head output in the non-agricultural activities is generally much higher than in agriculture, a shift to those activities stimulates the overall level of economic development.

Although Pakistan made a successful attempt in the 1950's and particularly

TABLE 5.2

CROP PRODUCTION AND YIELD IN THE PUNJAB, PAKISTAN AND SOME OTHER COUNTRIES AND REGIONS, 1978

Country/ Region	Production										Yield (quint/ha)				
	Foodgrains		Wheat		Rice		Cotton		Sugarcane		Food-grains	Wheat	Rice	Cotton	Sugar-cane
	mill. tonnes	% of Wld.	mill. tonnes	% of Wld.	mill. tonnes	% of Wld.	mill. tonnes	% of Wld.	mill. tonnes	% of Wld.					
PUNJAB	8.9	0.6	6.8	1.5	1.5	0.4	1.3	3.4	21.8	2.8	13.7	14.8	21.0	11.9	378.9
PAKISTAN	14.5	0.9	8.3	1.9	4.7	1.2	1.7	4.5	30.1	3.9	14.3	13.1	25.5	8.2	365.7
India	140.6	8.9	31.3	7.1	79.0	21.0	3.7	9.8	181.6	23.2	13.5	14.8	19.7	4.7	564.2
China	261.0	16.5	44.0	10.0	131.8	35.0	6.3	16.7	47.1	6.0	20.6	14.0	35.3	13.7	698.3
Bangladesh	19.3	1.2	-	-	18.9	5.0	-	-	6.7	0.9	18.8	-	18.9	-	446.7
USSR	229.5	14.5	120.8	27.4	2.1	0.6	8.5	22.5	-	-	18.6	19.2	36.2	28.0	-
Turkey	24.1	1.5	16.5	3.7	-	-	1.3	3.4	-	-	17.8	17.7	-	20.5	-
Egypt	8.3	0.5	1.9	0.4	2.4	0.6	1.2	3.2	9.2	1.2	40.6	33.3	54.3	23.1	782.2
USA	273.3	17.3	48.9	11.1	6.3	1.7	6.2	16.4	24.5	3.1	40.7	21.3	50.5	12.3	805.1
Mexico	17.4	1.1	2.6	0.6	-	-	0.9	2.4	34.5	4.4	17.7	34.8	-	24.8	718.8
Argentina	27.3	1.7	8.1	1.8	-	-	0.7	1.8	14.6	1.9	23.6	17.1	-	12.0	422.0
Brazil	23.9	1.5	2.7	0.6	7.2	1.9	1.4	3.7	129.2	16.5	11.9	8.9	13.0	7.1	535.4
ASIA (ex. USSR)	603.6	38.2	113.8	25.8	344.4	9.1	14.3	37.8	330.2	42.3	18.0	14.1	26.4	8.9	520.4
WORLD	1580.8	100.0	441.5	100.0	376.5	100.0	37.8	100.0	781.3	100.0	21.0	19.0	25.9	11.5	562.8

(-) Less than 0.5 million tonnes

SOURCES: 1. FAO Production Yearbook 1978
2. Agricultural Statistics of Pakistan 1978

in the 1960's to diversify its economy through industrial development, the industrial sector still occupies a far from significant position in the national economy. Further, although the agricultural sector has experienced a gradual decline in its share of the GNP, it has not been replaced by the manufacturing sector. Between 1972-3 and 1977-8, for instance, agriculture's share of the GNP declined from 36.5 to 32.2 per cent and the manufacturing sector's share also dropped from 15.7 to 13.4 per cent (Fig. 5.1). The loss in both sectors was taken up by other relatively less productive segments of the national economy. The share of construction rose from 3.8 to 4.9 and that of net income from the 'Rest of the World' from 0.5 to 5.5 per cent during the same period.

Thus, despite all efforts of the Planning machinery to transform Pakistan's economy rapidly, it remains essentially agricultural. As a result, the country continues to be heavily dependent on land resources for its income and on imports for its requirements of manufactured goods and energy needs. In 1947-8, the first year of Independence, Pakistan's exports exceeded its imports by Rs.125.1 million or 39.2 per cent. But in the following year the balance of trade was reversed - a situation that has persisted ever since with only two interruptions, in 1950-1 and 1972-3. The high dependence on foreign trade, and particularly its structural imbalance, is not only a major constraint on the nation's economic progress but has also made Pakistan's economy vulnerable to international developments like inflation, recession and soaring oil prices. The recurring set-backs to agriculture have further widened the trade gap. In 1976-7, Pakistan's imports and exports amounted to Rs.23,012 and 11,294 million respectively, with a trade gap of Rs.11,718 million which was an all time record in Pakistan's thirty years history. In the import sector, 17.7 per cent of the total expenditure was incurred on oil, 12.6 per cent on foodstuffs and an overwhelming part of the rest on chemical and mechanical goods.

In the Fifth Five Year Plan (1978-83), emphasis has been placed on the improvement of agricultural production so as to remove the need to import

foodstuffs as well as to increase their export. In the industrial sector, attention is to be focussed on the completion of on-going projects particularly the cement, fertilizer, sugar and textile plants and Karachi Steel Mill. All this is aimed at narrowing the balance of payments by slashing imports and boosting exports.

5.4. THE POSITION OF THE PUNJAB IN PAKISTAN'S AGRICULTURE

As explained in Sections 2.6 and 4.4, a large part of the Punjab was, in its natural state, a barren unproductive area which was transformed by modern irrigation technology into a flourishing agricultural region. The development of agriculture via irrigation expansion commenced in the last quarter of the nineteenth century and, by the end of the 1920's, the Punjab had become the subcontinent's "granary", a position it has kept in Pakistan despite its division between India and Pakistan. And although in the post-Independence period, Pakistan's other provinces, particularly Sind, have made significant headway in agriculture, the Punjab has not lost its dominant position.

Table 5.3 indicates a variety of agricultural inputs and outputs in the Punjab and in Pakistan as a whole, during the period 1970-1/1974-5. As is evident, the Punjab, with about one fourth of the national territory, contains almost three fifths of the country's cultivated area. Further, the Punjab, with a lower amount of current fallow than the other provinces and a relatively larger double cropped area, has a still higher share of the country's net sown and total cropped areas - 69.2 and 69 per cent respectively. The Province's dominant position is also reflected in the crop areas and productions. It produces 76.6 per cent of Pakistan's wheat, 66.9 per cent of its total foodgrains, 71.4 per cent of its cotton, 69.9 per cent of its sugarcane, 78.3 per cent of its vegetables and over 90 per cent of its fruit.

In addition, with 57.6 per cent of Pakistan's total and 58.4 per cent of its rural population, the Punjab has obviously the largest agricultural labour force

TABLE 5.3 AVERAGE ANNUAL AGRICULTURAL INPUTS AND OUTPUTS*IN PAKISTAN AND PUNJAB, 1970-1/1974-5

ITEM			PAKISTAN	PUNJAB	
			Total	Total	% of Pakistan
LANDUSE	Total Area		79,610	20,630	25.9
	Cultivated Area		19,200	11,100	57.8
	Net Sown Area		14,300	9,900	69.2
	Total Cropped Area		17,100	11,800	69.0
	Total Irrigated Area		13,000	9,200	70.8
	Canal Irrigated Area		9,700	6,600	68.0
	Ground water Irrigated Area		2,800	2,600	92.9
FOODCROPS	Wheat	Area	5,942	4,331	72.9
		Prod.	7,458	5,713	76.6
	Rice	Area	1,543	761	49.3
		Prod.	2,350	1,087	46.3
	Tot.Foodgrains	Area	9,485	6,146	64.8
		Prod.	11,296	7,555	66.9
CASH CROPS	Cotton	Area	1,955	1,500	76.7
		Prod.	650	464	71.4
	Sugarcane	Area	607	432	71.2
		Prod.	21,545	15,052	69.9
VEGETABLES		Area	124	84	67.7
		Prod.	1,582	1,238	78.3
PULSES	Gram	Area	996	713	71.6
		Prod.	540	386	71.5
	Mash	Area	43	37	86.0
		Prod.	21	18	85.7
OIL SEEDS	Cotton Seed	Area	1,955	1,500	76.7
		Prod.	1,298	927	71.4
	Edible oil Seeds	Prod.	293	198	67.6
FRUIT	Citrus Fruit	Area	48	44	91.7
		Prod.	534	489	91.6

* Area : 000 ha. Production : 000 tonnes
SOURCE: computed from : Agricultural Statistics of Pakistan 1975

in the country. Although the Province's agricultural labour force constitutes a slightly smaller proportion of its total labour force than that of Pakistan as a whole - 55.1 per cent versus 56.2 - the Province contains 59.6 per cent of the nation's agricultural labour force.

The Punjab's overwhelming role in the country's agricultural production in view, most of Pakistan's exports originate from the Punjab. Thus, the Province plays a vital role in the nation's foreign trade and earns a large part of its foreign currency.

5.5. LAND USE AND MAIN AGRICULTURAL AREAS

With the exception of a few small pockets in the northern and northwestern hilly regions and in the Baluchistan Plateau, the principal agricultural areas of Pakistan coincide with the river floodplains where canal irrigation is possible. Table 5.4 shows the major categories of land utilization in Pakistan and its provinces for the year 1976-7. It is interesting to note that 25.6 million ha. or almost one third of Pakistan's territory is the area not reported which, together with the current fallow, constitutes 30.4 million ha. or 38.2 per cent of the country's total area. Thus, although agriculture occupies a dominant position in the national economy, only one fourth of the total area is classed as cultivated and less than one fifth (19 per cent) is actually under crops.

The largest non-reporting areas, comprising the unreclaimable desert tracts and dry hilly and rugged terrains beyond the range of river waters and in the tribal belts, are found in Baluchistan (15.6 mill.ha) and the North West Frontier (5.1 mill.ha). Thus, whereas the reported area constitutes 82.5 and 90.8 per cent of the total area in the Punjab and Sind respectively, in the NWF and Baluchistan it accounts for only 50 and 55 per cent respectively (Fig.5.2).

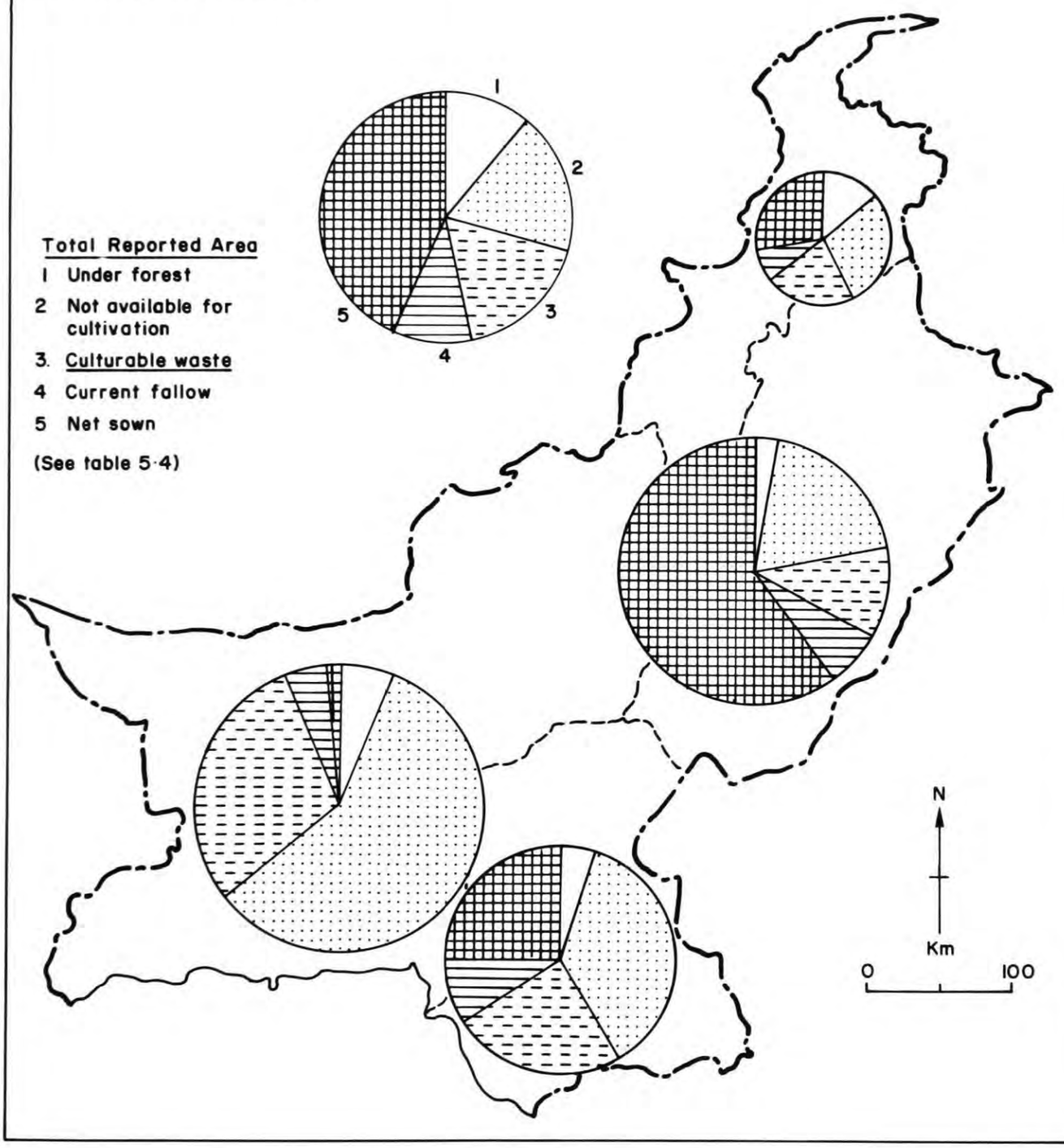
As in total area, the dry rugged Baluchistan leads the country's provinces in the reported area. But, although it contains 43.6 per cent of Pakistan's

TABLE 5.4 LAND UTILIZATION OF PAKISTAN AND PROVINCES, 1976-7
(million ha)

Category	Pakistan	Punjab	Sind	NWF	Baluch-istan
Geographical Area	79.6	20.6	14.1	10.2	34.7
Total Area Reported	54.0	17.0	12.8	5.1	19.1
Forest Area	2.8	0.4	0.6	0.7	1.1
Not Available for cultivation	20.7	3.3	4.7	1.5	11.2
Culturable Waste	10.6	1.9	2.0	1.1	5.6
Cultivated Area	19.9	11.4	5.5	1.8	1.2
Current Fallow	4.8	1.2	2.3	0.4	0.9
Net Area Sown	15.1	10.2	3.2	1.4	0.3
Area Sown more than once	2.9	2.0	0.5	0.4	0.0
Total Cropped area	18.0	12.2	3.7	1.8	0.3

SOURCE : converted from : Agricultural Statistics of Pakistan 1977

Fig 5·2
LAND UTILIZATION OF PAKISTAN
BY PROVINCES, 1976-7



total and 35.4 per cent of its reported area, it has less than 2 per cent of the country's net sown area.

Intensity of land use is a useful index to express the extent to which the cultivable land is used for production. It shows the percentage of cultivated area in the total culturable area (cultivated plus culturable waste). In the case of Pakistan, the intensity of land use was 65.2 per cent in 1976-7, compared with 85.7, 73.3, 62.1 and 17.6 per cent of the Punjab, Sind, the NWF and Baluchistan respectively. In the Punjab's districts, the intensity of land use is universally high, and except in Dera Ghazi Khan, Muzaffargarh and Mianwali where it is 48.2, 56.2 and 75.3 per cent respectively, it is well above 80 per cent, with the highest in Sialkot - 97.2 per cent.

According to the 1970-1/1974-5 averages, Pakistan's total cultivated area was 19.2 million ha. (Appendix VI). Thus, whereas the per capita share of the total territory was over 1.2 ha, it was less than one fourth of that in terms of total cultivated area and still less in the net sown, total cropped and total irrigated areas (Table 5.5). It is interesting to note that, although the country's leading province, the Punjab, contains 57.8, 69.2, 69 and 70.8 per cent of Pakistan's total cultivated, net sown, total cropped and total irrigated area respectively (Appendices VI-X), in the per capita cultivated area it stands higher than only the NWF (Table 5.5). This is due not only to the Punjab's large population size but also to the fact that, in Baluchistan and Sind, the total cultivated area includes large tracts of fallow which exaggerate the total amount of cultivated land. This can be better comprehended by comparing the percentage of current fallow in the total cultivated area in each unit. Whereas in the Punjab, current fallow constitutes only 10.5 per cent of the total cultivated, it is 41.8 per cent in Sind, 22.2 in the NWF, 75 in Baluchistan and 24.1 per cent in Pakistan as a whole. Thus, looking at the distribution of agricultural areas from a different angle, the Punjab has the highest per capita net sown, total cropped and total irrigated areas among the provinces of Pakistan and its averages are higher too than those of the country as a whole (Table 5.5).

TABLE 5.5 SOME SELECTED AGRICULTURAL INPUTS AND OUTPUTS PER CAPITA IN PAKISTAN AND PROVINCES, 1970-1/1974-5

Territory	Area (ha)					Production (kg)	
	Tot. land	Tot. cultd.	Net sown	Tot. cropped	Tot. Irrig.	Wheat	Tot. Foodgrains
Punjab	0.55	0.30	0.26	0.31	0.24	152	201
Sind	0.99	0.37	0.19	0.23	0.19	80	177
NWF	0.93	0.15	0.12	0.16	0.06	61	123
Baluchistan	14.47	0.50	0.17	0.17	0.17	38	82
PAKISTAN	1.22	0.29	0.22	0.26	0.20	114	173

SOURCE : As in Table 5.3

In order to have a comprehensive picture of the land use in the country and particularly in the Punjab, we now discuss the distribution of the various categories of agricultural area in detail.

5.5.1. Distribution of the Total Cultivated and Net Sown Areas

Total cultivated area, defined as the farm area sown at least once during a particular crop year, comprises two categories of agricultural land. First, the net sown is the area actually cropped during a crop year, irrespective of the number of crops raised, and includes the area under fruit; and second, the current fallow, the land that has not been actually in crop use during a particular year but was cultivated for at least one harvest during the preceding year. It is therefore obvious that the net sown area constitutes a part of the total cultivated and its extent depends on the relative size of its complement - the current fallow. Any other land, fit for cultivation which has remained uncultivated for the past two years (or four harvests), is relegated to the category of "culturable waste". Figure 5.3 presents a comprehensive view of agricultural land use in the Punjab's districts during the period 1970-1/1974-5.

Between 1948-9 and 1952-3, the Punjab's total cultivated area amounted to about 9.1 million ha. or 59.9 per cent of Pakistan's total. By 1970-1/1974-5, the Province's total cultivated area increased by 2 million ha. but its share in the country's total dropped by 2.1 percentage points (Appendix VI).

Table 5.6 shows the distribution of total cultivated and net sown areas in the Punjab by divisions and districts and reveals marked regional contrasts in the distributional pattern within these areal units. The old canal colony districts : Multan, Sargodha and Sahiwal, with the largest size of total cultivated area, stand in sharp contrast to Bahawalpur, Rawalpindi and Jhelum with the smallest sizes. While the first three contain 10.5, 8.8 and 8.2 per cent of the Province's total cultivated area respectively, in each of the seven districts at the other end of the scale the share is below 4 per cent. In fact,

TABLE 5.6

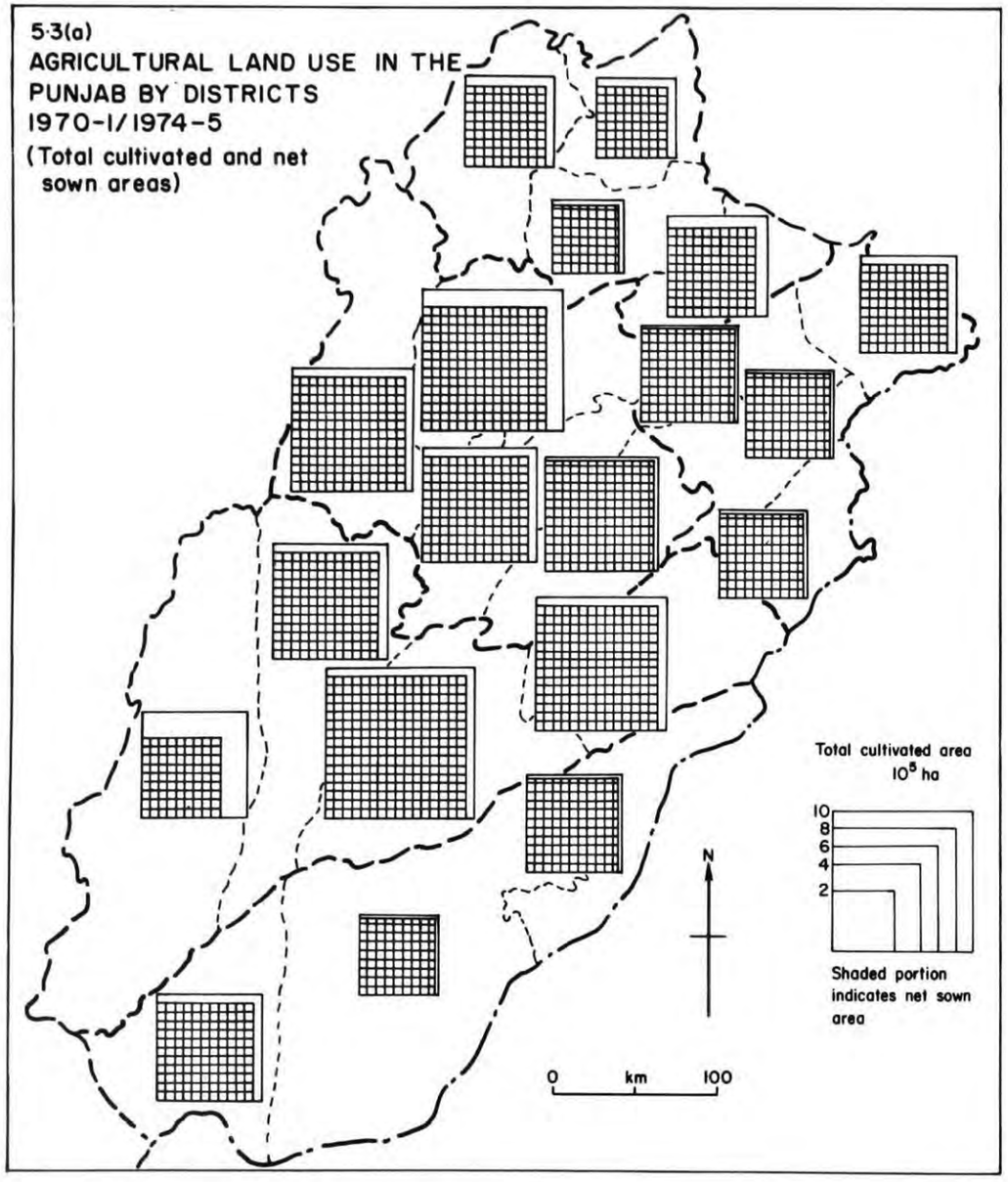
TOTAL CULTIVATED AND NET SOWN AREA, THE PUNJAB, DIVISIONS AND DISTRICTS, 1951-72

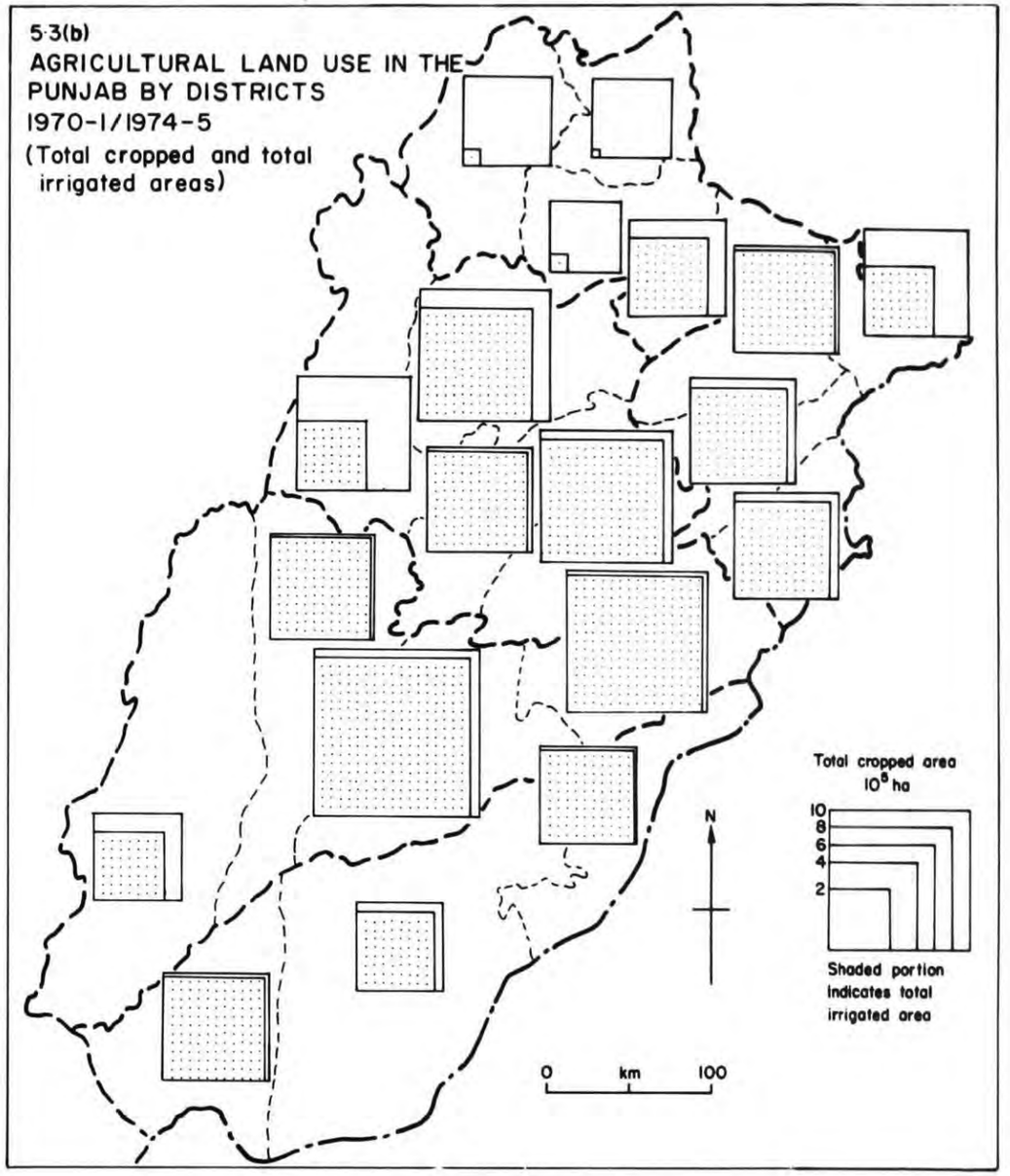
Division/District	Total Cultivated Area						Net Sown Area					
	000 ha			% Change			000 ha			% Change		
	1951(1)	1961(2)	1972(3)	1951-61	1961-72	1951-72	1951	1961	1972	1951-61	1961-72	1951-72
I. RAWALPINDI DIV.	1,400	1,431	1,471	2.2	2.8	5.1	1,263	1,345	1,349	6.5	0.3	6.8
1. RWP	234	264	298	12.8	12.9	27.4	221	242	269	9.5	11.2	21.7
2. CPR	457	443	438	-3.1	-1.1	-4.2	393	403	377	2.5	-6.5	-4.1
3. JLM	289	291	289	0.7	-0.7	0.0	257	274	269	6.6	-1.8	4.7
4. GJT	420	433	446	3.1	3.0	6.2	392	426	434	8.7	1.9	10.7
II. SARGODHA DIV.	2,449	2,800	3,153	14.3	12.6	28.7	2,080	2,538	2,764	22.0	8.9	32.9
5. SRG	734	853	973	16.2	14.1	32.6	613	782	803	27.6	2.7	31.0
6 MWI	517	659	790	27.5	19.9	52.8	404	566	687	40.1	21.4	70.0
7. JNG	461	573	654	24.3	14.1	41.9	382	515	573	34.8	11.3	50.0
8. LYP	737	715	736	-3.0	2.9	-0.1	681	675	701	-0.9	3.9	2.9
III. LAHORE DIV.	1,594	1,609	1,767	0.9	9.8	10.9	1,393	1,470	1,636	5.5	11.3	17.4
9. LHR	388	410	410	5.7	0.0	5.7	309	365	382	18.1	4.7	23.6
10. SLT	422	431	439	2.1	1.9	4.0	385	407	405	5.7	-0.5	5.2
11. GWA	391	389	482	-0.5	23.9	23.3	345	357	444	3.5	24.4	28.7
12. SHA	393	379	436	-3.6	15.0	10.9	354	341	405	-3.7	18.8	14.4
IV. MULTAN DIV.	2,462	2,890	3,298	17.4	14.1	34.0	2,037	2,278	2,895	11.8	27.1	42.1
13. MTN	936	1,060	1,171	13.2	10.5	25.1	826	920	1,087	11.4	18.2	31.6
14. SWL	791	808	915	2.1	13.2	15.7	673	718	834	6.7	16.2	23.9
15. MZG	340	429	662	26.2	54.3	94.7	277	370	605	33.6	63.5	118.4
16. DGK	395	593	550	50.1	-7.3	39.2	261	270	369	3.4	36.7	41.4
V. BAHAWALPUR DIV.	1,170	1,279	1,429	9.3	11.7	22.1	986	1,177	1,293	19.4	9.9	31.1
17. BWP	278	300	352	7.9	17.3	26.6	234	276	323	17.9	17.0	38.0
18. BWN	461	486	517	5.4	6.4	12.1	367	453	471	23.4	4.0	28.3
19. RYK	431	493	560	14.4	13.6	29.9	385	448	499	16.4	11.4	29.6
PUNJAB	9,075	10,009	11,118	10.3	11.1	22.5	7,759	8,808	9,937	13.5	12.8	28.1

NOTES : Minor discrepancies in the percentage changes of the Punjab's totals between this Table and Appendices VI-X are due to rounding figures.

(1) Average for the period 1948-9/1952-3 (2) Average for the period 1958-9/1962-3 (3) Average for the period 1970-1/1974-5.

SOURCES : Computed from 1. Statistics of West Pakistan-Agricultural Data 1947-8/1958-9
2. West Pakistan Agricultural Statistics 1954-5/1964-5
3. Punjab Agricultural Statistics 1965-6/1974-5 (8 vols)


5·3(a)
AGRICULTURAL LAND USE IN THE PUNJAB BY DISTRICTS 1970-1/1974-5
(Total cultivated and net sown areas)
Total cultivated area 10^5 ha
10
8
6
4
2
Shaded portion indicates net sown area
N
0 km 100


5·3(b)
AGRICULTURAL LAND USE IN THE PUNJAB BY DISTRICTS 1970-1/1974-5
(Total cropped and total irrigated areas)
Total cropped area 10^5 ha
10
8
6
4
2
Shaded portion indicates total irrigated area
N
0 km 100

seven districts - the three above mentioned and Mianwali, Lyallpur, Muzaffargarh and Jhang - together contain 53.1 per cent of the Province's total cultivated area.

In terms of the per capita cultivated area, however, the picture is somewhat different. While the relatively newly colonized Mianwali leads the districts with 0.72 ha, in nine districts the per capita cultivated area is below the Provincial average of 0.30 ha (Table 5.7). Between 1948-9/1952-3 and 1970-1/1974-5, Mianwali passed through a revolutionary phase when, due to the application of newly developed canal irrigation, its total cultivated area expanded by 52.8 per cent from 517,000 to 790,000 ha. Despite a rapid population increase to which in-migration contributed significantly, the district has kept its high position in the per capita figure. Other districts with significant per capita cultivated area are : Dera Ghazi Khan (0.48 ha), Bahawalnagar(0.48) and Sargodha (0.46). In the old canal colony districts, on the other hand, the corresponding figure is relatively low : 0.32 ha. in Sahiwal, 0.29 in Multan, 0.26 in Sheikhupura, 0.17 in Lyallpur and the lowest, 0.11 ha, in Lahore.

In the first three old canal colony districts, although the population pressure, fragmentation and sharply rising land values have, in recent years, encouraged out-migration (Section 3.6), the great bulk of rural population is still content on the existing land resources with an attempt to intensify agriculture. Even most of the out-migrants left a number of their family members in these areas. However, the last two districts - Lahore and Lyallpur - have large urban populations which explain their low per capita cultivated area.

As described earlier, the distribution of cultivated area corresponds to the availability of water, the coefficient of correlation (r) between the total cultivated and total irrigated areas being +0.805 and that between total cultivated and canal irrigated areas +0.813 for all districts; and +0.755 and +0.764 respectively for the 16 districts occupying the Punjab Plain. Thus, except in the three Potwar districts, cultivated area is closely associated

TABLE 5.7

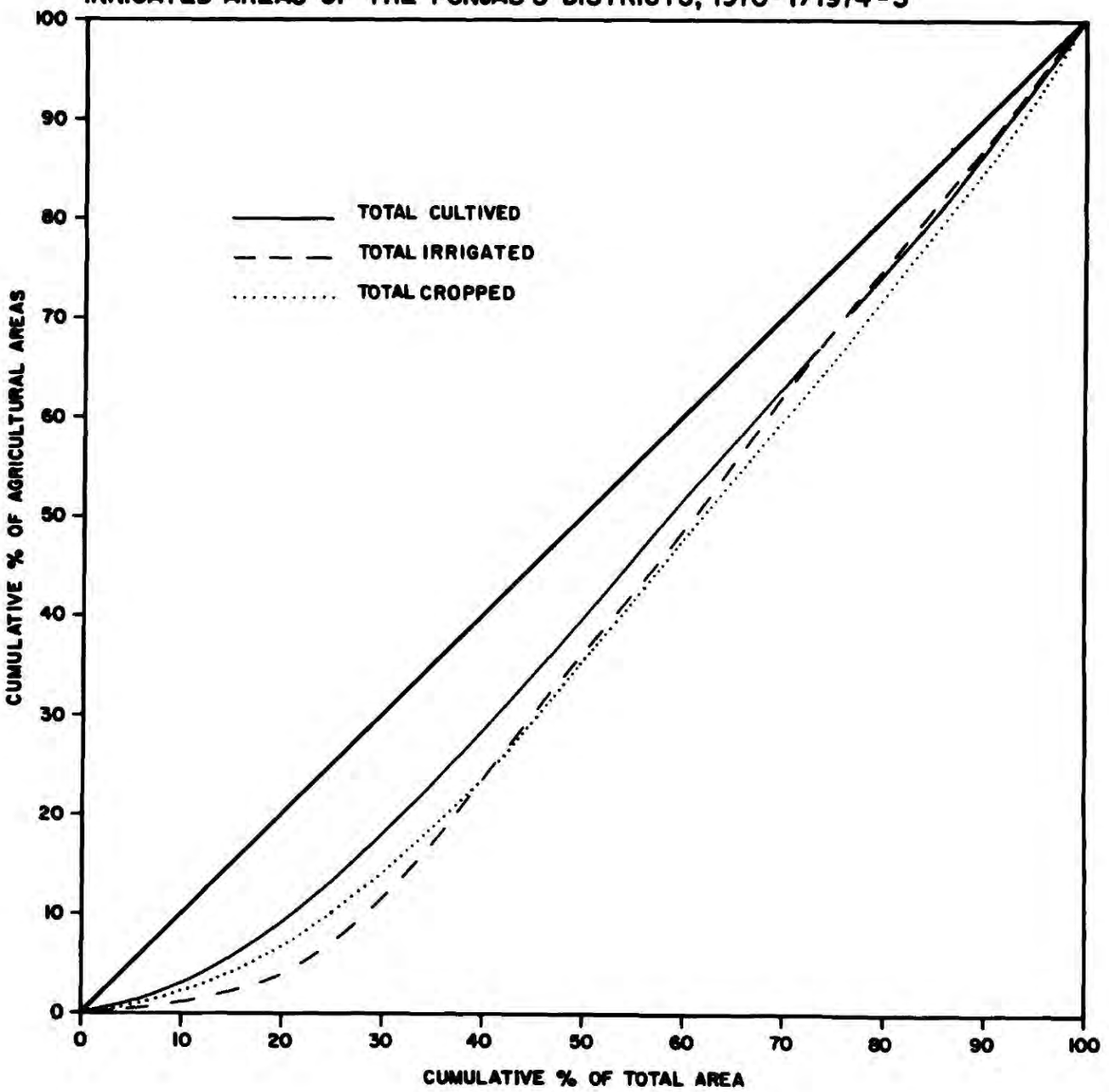
SOME SELECTED AGRICULTURAL INPUTS AND OUTPUTS PER CAPITA, THE PUNJAB, DIVISIONS AND DISTRICTS, 1970-1/1974-5

Division/District	Area (ha)					Production (kg)	
	Tot. Land	Tot. Cultd.	Net Sown	Tot. Cropped	Tot. Irrig.	Wheat	Tot. foodgrains
I. RAWALPINDI DIV.	0.50	0.26	0.24	0.26	0.07	75	118
1. RWP	0.30	0.17	0.15	0.17	0.01	38	68
2. CPR	1.00	0.45	0.38	0.41	0.02	120	157
3. JLM	0.68	0.27	0.26	0.27	0.02	67	100
4. GJT	0.31	0.23	0.23	0.27	0.17	92	154
II. SARGODHA DIV.	0.49	0.35	0.31	0.35	0.26	175	210
5. SRG	0.59	0.46	0.38	0.46	0.32	191	241
6. MWI	1.28	0.72	0.63	0.65	0.24	172	190
7. JNG	0.56	0.42	0.37	0.38	0.36	212	249
8. LYP	0.21	0.17	0.17	0.21	0.20	154	186
III. LAHORE DIV.	0.23	0.18	0.17	0.23	0.20	110	194
9. LHR	0.15	0.11	0.10	0.14	0.14	69	99
10. SLT	0.23	0.19	0.17	0.23	0.12	102	182
11. GWA	0.29	0.23	0.22	0.30	0.29	154	299
12. SHA	0.36	0.26	0.24	0.33	0.32	159	298
IV. MULTAN DIV.	0.67	0.35	0.30	0.36	0.33	218	253
13. MTN	0.36	0.29	0.27	0.34	0.34	206	224
14. SWL	0.38	0.32	0.29	0.38	0.36	245	301
15. MZG	0.93	0.42	0.39	0.40	0.35	254	276
16. DGK	2.12	0.48	0.32	0.33	0.22	144	201
V. BAHAWALPUR DIV.	1.29	0.40	0.36	0.41	0.39	154	188
17. BWP	2.32	0.33	0.30	0.35	0.34	141	169
18. BWN	0.83	0.48	0.44	0.48	0.44	169	209
19. RYK	0.85	0.40	0.36	0.39	0.38	152	187
PUNJAB	0.55	0.30	0.26	0.31	0.24	152	201

NOTES AND SOURCES : As in Table 5.6

Fig 5.4

LORENZ CURVE FOR THE THE TOTAL CULTIVATED, TOTAL CROPPED AND IRRIGATED AREAS OF THE PUNJAB'S DISTRICTS, 1970-1/1974-5



with the existence of irrigation facilities through canals and/or groundwater sources. Figure 5.4 shows the distribution of the total cultivated, total cropped and total irrigated areas in the Punjab by districts for the period 1970-1/1974-5. As is clear, the minor differences between the three curves notwithstanding, they are fairly similar. It is also evident that except at the lower end, where the Bahawalpur and Dera Ghazi Khan districts with a very high percentage share of the total but a low share of the agricultural area flatten the curve, the distribution of agricultural areas between districts corresponds fairly closely to their share of the Province's total area (Table 5.8).

The ratio of the cultivated to the total area in a region is a useful indicator of the agricultural land use. Between 1970-1 and 1974-5, the Punjab's cultivated area constituted 53.9 per cent of its total area. The corresponding figures for Sind, the NWF and Baluchistan were 37.6, 15.7 and 3.5 per cent respectively and 24.1 for Pakistan as a whole (Appendix VI). In 13 of the Punjab's districts, in turn, the ratio was higher than the Province's with the highest in Sahiwal - 83.6 per cent. In all, in 10 districts it exceeded 70 per cent and in only two : Dera Ghazi Khan and Bahawalpur, was it below 25 per cent (Fig. 5.5(a)).

The distribution of net sown area presents a very similar picture to that of the total cultivated, with five districts : Multan, Sahiwal, Sargodha, Lyallpur and Mianwali together containing well above two fifths of the Province's total net sown area (Tables 5.6 and 5.8). The ratio of the net sown to the total area, though lower than that of the total cultivated, bears a great resemblance to the latter. In addition, since a high proportion of the total cultivated is actually under crops, in almost all districts the net sown constitutes a high percentage of the total cultivated. In fact, in 13 districts the ratio of net sown to the total cultivated area is well above 90 per cent, with the highest in Gujrat - 97.3 per cent. The only district where it is below 80 per cent is Dera Ghazi Khan - 67.1 per cent (Fig. 5.5(b)). Obviously the net sown area has a

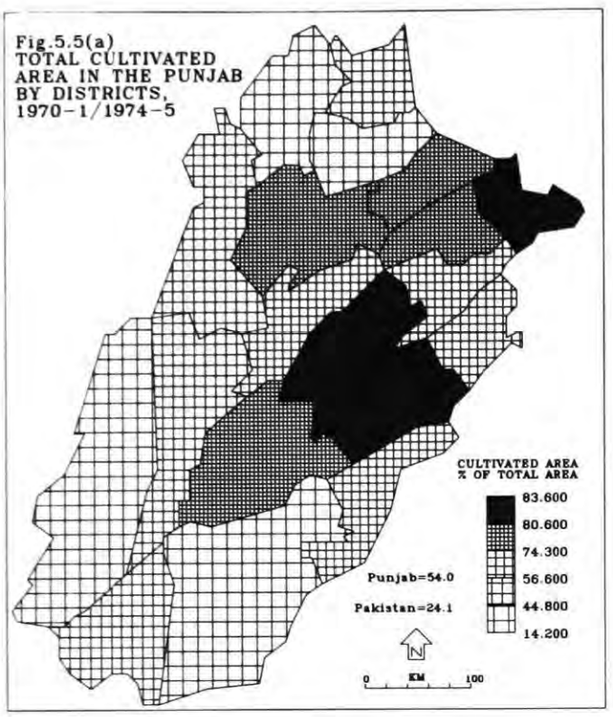


Fig.5.5(a)
TOTAL CULTIVATED
AREA IN THE PUNJAB
BY DISTRICTS,
1970-1/1974-5
CULTIVATED AREA
% OF TOTAL AREA
83.600
80.600
74.300
56.600
44.800
14.200
Punjab=54.0
Pakistan=24.1
N
0 KM 100

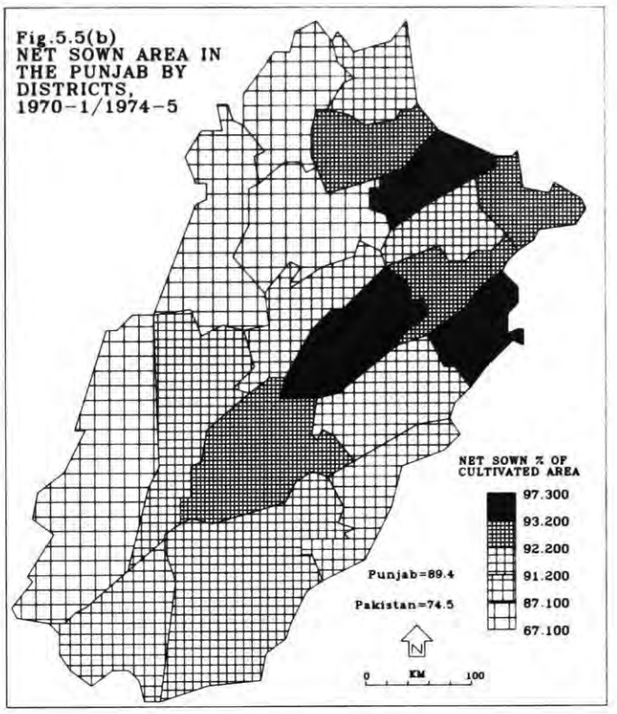


Fig.5.5(b)
NET SOWN AREA IN
THE PUNJAB BY
DISTRICTS,
1970-1/1974-5
NET SOWN % OF
CULTIVATED AREA
97.300
93.200
92.200
91.200
87.100
67.100
Punjab=89.4
Pakistan=74.5
N
0 KM 100

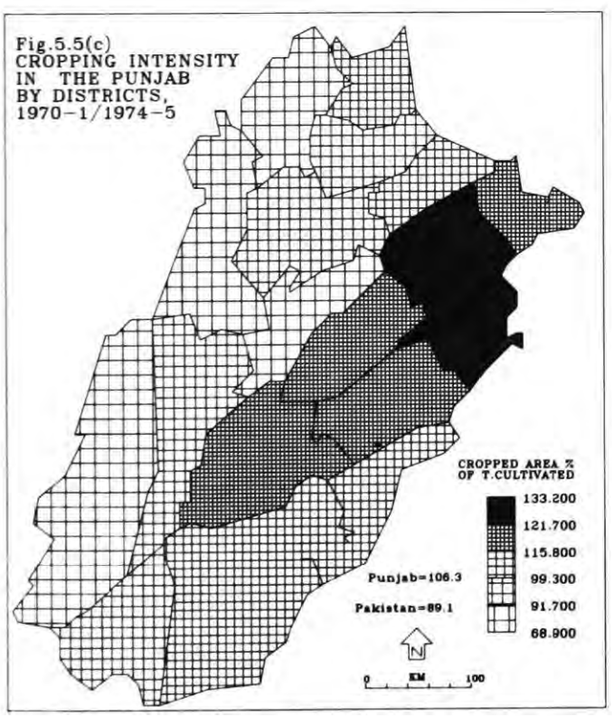


Fig.5.5(c)
CROPPING INTENSITY
IN THE PUNJAB
BY DISTRICTS,
1970-1/1974-5
CROPPED AREA %
OF T.CULTIVATED
133.200
121.700
115.800
99.300
91.700
68.900
Punjab=106.3
Pakistan=89.1
N
0 KM 100

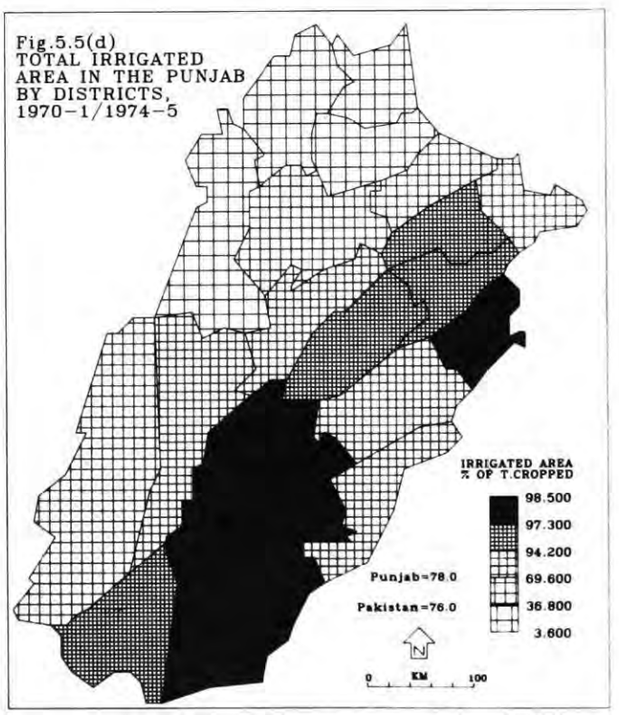


Fig.5.5(d)
TOTAL IRRIGATED
AREA IN THE PUNJAB
BY DISTRICTS,
1970-1/1974-5
IRRIGATED AREA
% OF T.CROPPED
98.500
97.300
94.200
69.600
36.800
3.600
Punjab=78.0
Pakistan=76.0
N
0 KM 100

TABLE 5.8

SHARE OF DIVISIONS AND DISTRICTS IN THE PUNJAB'S TOTALS, 1970-1/1974-5

(PER CENT)

Division/District	Tot. Area	Tot. Cultd.	Net Sown	Tot. cropped	Tot. Irrigated	Canal Irrigated	Well and Tube well Irrigated
I. RAWALPINDI DIV.	13.7	13.2	13.6	12.7	4.1	3.4	5.8
1. RWP	2.6	2.7	2.7	2.5	0.1	0	0.3
2. CPR	4.8	3.9	3.8	3.4	0.3	0	0.8
3. JLM	3.5	2.6	2.7	2.4	0.2	0	0.7
4. GJT	2.8	4.0	4.4	4.4	3.5	3.4	4.0
II. SARGODHA DIV.	21.6	28.4	27.8	26.8	25.4	29.1	16.3
5. SRG	6.0	8.8	8.1	8.2	7.3	8.3	4.7
6. MNI	6.8	7.1	6.9	6.1	2.8	2.8	3.0
7. JNG	4.3	5.9	5.8	5.0	6.1	6.1	6.3
8. LYP	4.5	6.6	7.0	7.5	9.2	11.9	2.3
III. LAHORE DIV.	11.2	15.9	16.5	19.0	21.1	14.5	38.6
9. LHR	2.8	3.7	3.8	4.6	5.8	5.5	6.7
10. SLT	2.6	3.9	4.1	4.5	3.0	0.1	10.8
11. GWA	2.9	4.4	4.5	5.2	6.5	3.9	13.3
12. SHA	2.9	3.9	4.1	4.7	5.8	5.0	7.8
IV. MULTAN DIV.	31.3	29.6	29.1	29.3	34.5	35.2	32.1
13. MTN	7.1	10.5	10.9	11.7	14.7	16.6	10.1
14. SWL	5.3	8.2	8.4	9.1	11.0	10.6	12.6
15. MZG	7.1	6.0	6.1	5.3	6.0	5.1	7.7
16. DGK	11.8	4.9	3.7	3.2	2.8	2.9	1.7
V. BAHAWALPUR DIV.	22.2	12.9	13.0	12.2	14.9	17.8	7.2
17. BWP	12.1	3.2	3.3	3.2	3.9	4.0	3.5
18. BWN	4.3	4.7	4.7	4.4	5.2	6.9	0.9
19. RYK	5.8	5.0	5.0	4.6	5.8	6.9	2.8
PUNJAB	100.0	100.0	100.0	100.0	100.0	100.0	100.0

SOURCES : As in Table 5.6

greater dependence than the total cultivated on the availability of water which increases it by restricting the current fallow. This is brought home by the higher values of the coefficient of correlation for all districts between the net sown and total irrigated areas(+0.854) and the net sown and the canal irrigated areas(+0.854).

5.5.2. Distribution of the Total Cropped Area and Cropping Intensity

The total cropped or gross sown area means the aggregate area of crops in a particular year and is the sum total of the net sown and double cropped areas. It provides a comprehensive picture of the efficiency of the crop land. Faced with mounting population pressure and facilitated by the increased water supply, the Punjab has gradually increased its total cropped area by 39 per cent during the two decades before 1972, which amounted to 11.8 million ha. or 69 per cent of Pakistan's total between 1970-1 and 1974-5 (Appendix VIII).

Table 5. 9 shows the distribution of the total cropped area in the Punjab by divisions and districts, a graphic view of which is presented by Figure 5.4. As is clear, the distribution is markedly uneven with pronounced regional contrasts and the five leading districts - Multan, Sahiwal, Sargodha, Lyallpur and Mianwali - together contain over two fifths of the Province's or almost one third of the country's total cropped area.

Cropping intensity expressing the total cropped area in terms of the total cultivated is a more useful statistical index to show the extent to which the available cultivated area is used for cropping and reflects the single or double cropping. During the period 1970-1/1974-5, cropping intensity was 106.3 per cent in the Punjab compared with 60.4 in Sind, 33.3 in Baluchistan and 89.1 in Pakistan as a whole but, interestingly enough, the NWF equals the Punjab in this regard though its total cropped area is only one seventh of the Punjab's (Appendix VIII).

Among the Punjab's districts, those in the Rechna and Bari doabs, with

TABLE 5.9 TOTAL CROPPED AREA AND CROPPING INTENSITY, THE PUNJAB, DIVISIONS AND DISTRICTS, 1951-72

Division/District	Total Cropped Area 000 ha			% Change			Cropping Intensity*		
	1951	1961	1972	1951-61	1951-72	1951-72	1951	1961	1972
I. RAWALPINDI DIV.	1,350	1,439	1,500	6.6	4.2	11.1	96.4	100.6	102.0
1. RWP	241	275	302	14.1	9.8	25.3	103.0	104.2	101.3
2. CPR	415	416	401	0.2	-3.6	-3.4	90.8	93.9	91.6
3. JLM	273	286	281	4.8	-1.7	2.9	94.5	98.3	97.2
4. GJT	421	462	516	9.7	11.7	22.6	100.2	106.7	115.7
II. SARGODHA DIV.	2,169	2,699	3,171	24.4	17.5	46.2	88.6	96.4	100.6
5. SRG	647	814	965	25.8	18.6	49.1	88.1	95.4	99.2
6. MWI	411	571	717	38.9	25.6	74.5	79.5	86.6	90.8
7. JNG	384	519	597	35.2	15.0	55.5	83.3	90.6	91.3
8. LYP	727	795	892	9.4	12.2	22.7	98.6	111.2	121.2
III. LAHORE DIV.	1,535	1,788	2,250	16.5	25.8	46.6	96.3	111.1	127.3
9. LHR	329	426	546	29.5	28.2	66.0	84.8	103.9	133.2
10. SLT	412	490	534	18.9	9.0	29.6	97.6	113.7	121.6
11. GWA	397	460	619	15.9	34.6	55.9	101.5	118.3	128.4
12. SHA	397	412	551	3.8	33.7	38.8	101.0	108.7	126.4
IV. MULTAN DIV.	2,250	2,670	3,457	18.7	29.5	53.6	91.4	92.4	104.8
13. MTN	906	1,093	1,371	20.6	25.4	51.3	96.8	103.1	117.1
14. SWL	781	886	1,077	13.4	21.6	37.9	98.7	109.7	117.7
15. MZG	294	398	630	35.4	58.3	114.3	86.5	92.8	95.2
16. DGK	269	293	379	8.9	29.4	40.9	68.1	49.4	68.9
V. BAHAWALPUR DIV.	1,153	1,275	1,436	10.6	12.6	24.5	98.5	99.7	100.5
17. BWP	282	299	372	6.0	24.4	31.9	101.4	99.7	105.7
18. BWN	442	492	519	11.3	5.5	17.4	95.9	101.2	100.4
19. RYK	429	484	545	12.8	12.6	27.0	99.5	98.2	97.3
PUNJAB	8,457	9,871	11,814	16.7	19.7	39.7	93.2	98.6	106.3

* Total cropped area as percentage of the total cultivated.

NOTES AND SOURCES : As in Table 5.6

a greater quantity of irrigation water and higher population pressure, generally have a higher cropping intensity. Thus, Lahore (133.2 per cent), Gujranwala (128.4), Sheikhupura (126.4) and Sialkot (121.6) stand in sharp contrast to Dera Ghazi Khan (68.9), Mianwali (90.8) and Jhang (91.3) (Fig. 5.5(c)). During the two decades preceding 1970-1/1974-5, the Punjab increased its cropping intensity by 13.1 percentage points, from 93.2 to 106.3, when the most significant increases at district level were registered by Lahore (48.4), Gujranwala (26.9) and Sheikhupura (25.4). (Table 5.9). Such changes are discussed in detail in Section 5.6. However, it must be noted here that an analysis for the 1970-1/1974-5 data of the Punjab's districts revealed that cropping intensity has a strong correlation with : arithmetic density (r = +0.808), rural density (+0.793), net in-migration (+0.706), change in arithmetic density (+0.796), change in rural density (+0.754), level of mechanization (+0.844), level of chemical fertilizer use (+0.628) and the use of the tube well water (+0.626).

5.5.3. Distribution of the Irrigated Area

In the arid and semi-arid setting of the Punjab, water is the main constraint on plant growth. Irrigation is, therefore, a universal need except in a tiny northern and northeastern strip. Thus, over a dominant part of the Province, the share of the cropped area irrigated in one way or the other exceeds 75 per cent and is, in a large part, over 90 per cent. Overall, almost 78 per cent of the Punjab's total cropped area was irrigated during the period 1970-1/1974-5, leaving less than one fourth as barani (rain-fed). In eight of the 19 districts, the share of irrigated area in the total cropped is less than the Province's average. The Potwar districts of Rawalpindi, Campbellpur and Jhelum are virtually without irrigation, while in Mianwali it is insignificant and the district, despite a rapid development of irrigation since Independence, still has a little over one third of its cropped area irrigated from all sources. In Sialkot too, the share of irrigated area in the total cropped is low - 52.6 per cent, and the district has only 3 per cent of the Province's total irrigated

TABLE 5.10

TOTAL AND CANAL IRRIGATED AREA, THE PUNJAB, DIVISIONS AND DISTRICTS, 1951-72

Division/District	Total Irrigated Area						Canal Irrigated Area					
	000 ha			% Change			000 ha			% Change		
	1951	1961	1972	1951-61	1961-72	1951-72	1951	1961	1972	1951-61	1961-72	1951-72
I. RAWALPINDI DIV.	235	284	379	20.9	33.5	61.3	146	198	228	35.6	15.2	56.2
1. RWP	4	7	11	75.0	57.1	175.0	0	2	3	-	50.0	-
2. CPR	27	21	24	-22.2	14.3	-11.1	0	2	2	-	0.0	-
3. JLM	11	11	18	0.0	63.6	63.6	0	0	0	-	-	-
4. GJT	193	245	326	26.9	33.1	68.9	146	194	223	32.9	14.9	52.7
II. SARGODHA DIV.	1,518	1,925	2,336	26.8	21.4	53.9	1,334	1,680	1,912	25.9	13.8	43.3
5. SRG	427	530	671	24.1	26.6	57.1	367	500	548	36.2	9.6	49.3
6. MNI	38	122	263	221.1	115.6	592.1	19	104	185	447.4	77.9	873.7
7. JNG	344	503	557	46.2	10.7	61.9	256	328	394	32.0	16.6	53.9
8. LYP	709	770	845	8.6	9.7	19.2	692	738	785	6.6	6.4	13.4
III. LAHORE DIV.	1,122	1,339	1,944	19.3	45.2	73.3	679	796	954	17.2	19.8	40.5
9. LHR	312	401	535	28.5	33.4	71.5	226	292	359	29.2	22.9	58.8
10. SLT	169	157	281	-7.1	79.0	66.3	2	11	7	450.0	-36.4	250.0
11. GWA	307	382	597	24.4	56.3	94.5	167	202	256	21.0	26.7	53.3
12. SHA	334	399	531	19.5	33.1	59.0	284	291	332	2.5	14.1	16.9
IV. MULTAN DIV.	1,987	2,448	3,171	23.2	29.5	59.6	1,695	1,924	2,314	13.5	20.3	36.5
13. MTN	859	1,073	1,351	24.9	25.9	57.3	763	827	1,091	8.4	31.9	43.0
14. SWL	758	872	1,013	15.0	16.2	33.6	665	687	694	3.3	1.0	4.4
15. MZG	229	335	555	46.3	65.7	142.4	151	261	337	72.8	29.1	123.2
16. DGK	141	168	252	19.1	50.0	78.7	116	149	192	28.4	28.9	65.5
V. BAHAWALPUR DIV.	1,002	1,147	1,368	14.5	19.3	36.5	886	1,076	1,169	21.4	8.6	31.9
17. BWP	222	271	363	22.1	33.9	63.5	201	249	259	23.9	4.0	28.9
18. BWN	401	425	475	6.0	11.8	18.5	356	405	453	13.8	11.9	27.2
19. RYK	379	451	530	19.0	17.5	39.8	329	422	457	28.3	8.3	38.9
PUNJAB	5,864	7,143	9,198	21.8	28.8	56.9	4,740	5,674	6,577	19.7	15.9	38.8

NOTES AND SOURCES : As in Table 5.6

and a mere 0.1 per cent of its canal irrigated area (Table 5.8). However, lying in the submontane strip and with a higher water table, Sialkot has traditionally been a ground water irrigated area. It now has over one tenth of the Punjab's area irrigated from ground water sources.

The five districts with the lowest share of the cropped area and the slightest level of irrigation, Rawalpindi, Campbellpur, Jhelum, Dera Ghazi Khan and Bahawalpur together, with almost 35 per cent of the Province's territory and 14.7 per cent of its total cropped area, have only 7 per cent of the Punjab's total irrigated and canal irrigated area. On the other hand, the four districts with the highest shares of the Province's total cropped area : Multan, Sahiwal, Sargodha and Lyallpur, together have 23 per cent of the Punjab's total area, 36.5 per cent of its cropped, 42 per cent of its total irrigated and nearly half of its canal irrigated area (Table 5.10).

Not only does the amount of irrigated area vary between sources and districts, but the share of the irrigated in the total cropped area also exhibits marked regional variations. Figure 5.6 (a) shows the pattern of water utilization in the Punjab by indicating, at the district level, the area irrigated from various sources. As can be seen, the proportion of irrigated area generally increases from north to south, from under 4 per cent in Rawalpindi to over 98 per cent in Multan and 97.2 in Rahimyar Khan. In all, in ten central and southern districts, the irrigated area constitutes over 90 per cent of the total cropped.

As discussed in Section 2.6, the region witnessed a momentous change in its pattern of water utilization during the 1960's when, with the aid of increased electricity and oil supplies, ground water exploitation became, for the first time, universal throughout the Province through a rapid expansion of tube wells. As a result, groundwater availability not only increased in the old "well and tube well" districts in the central <u>doabs</u>, but also began to increase in the hitherto "well-less" districts such as the northern Potwar and

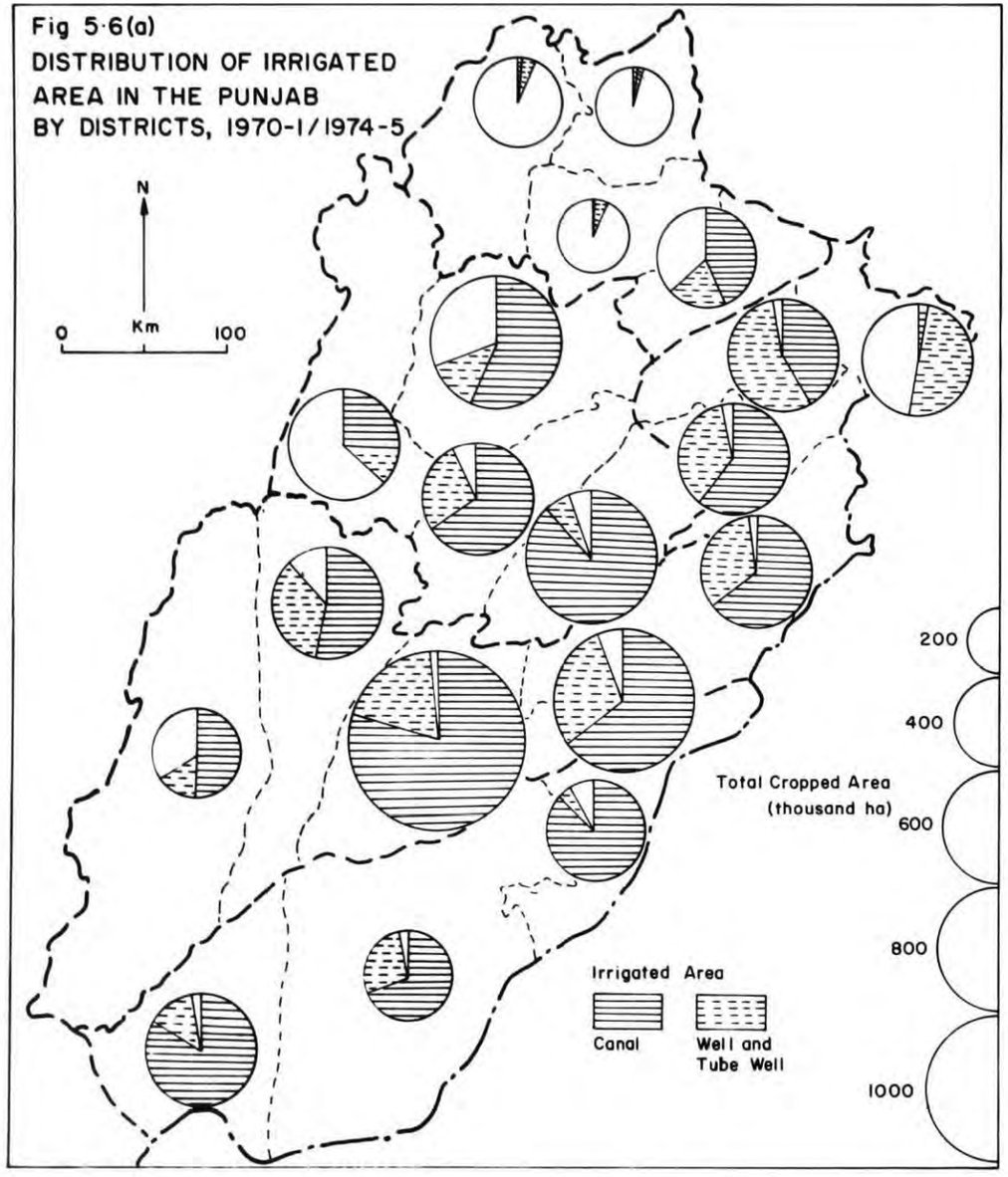


Fig 5·6(a)
DISTRIBUTION OF IRRIGATED
AREA IN THE PUNJAB
BY DISTRICTS, 1970-1/1974-5
N
0
Km
100
200
400
600
800
1000
Total Cropped Area
(thousand ha)
Irrigated Area
Canal
Well and
Tube Well

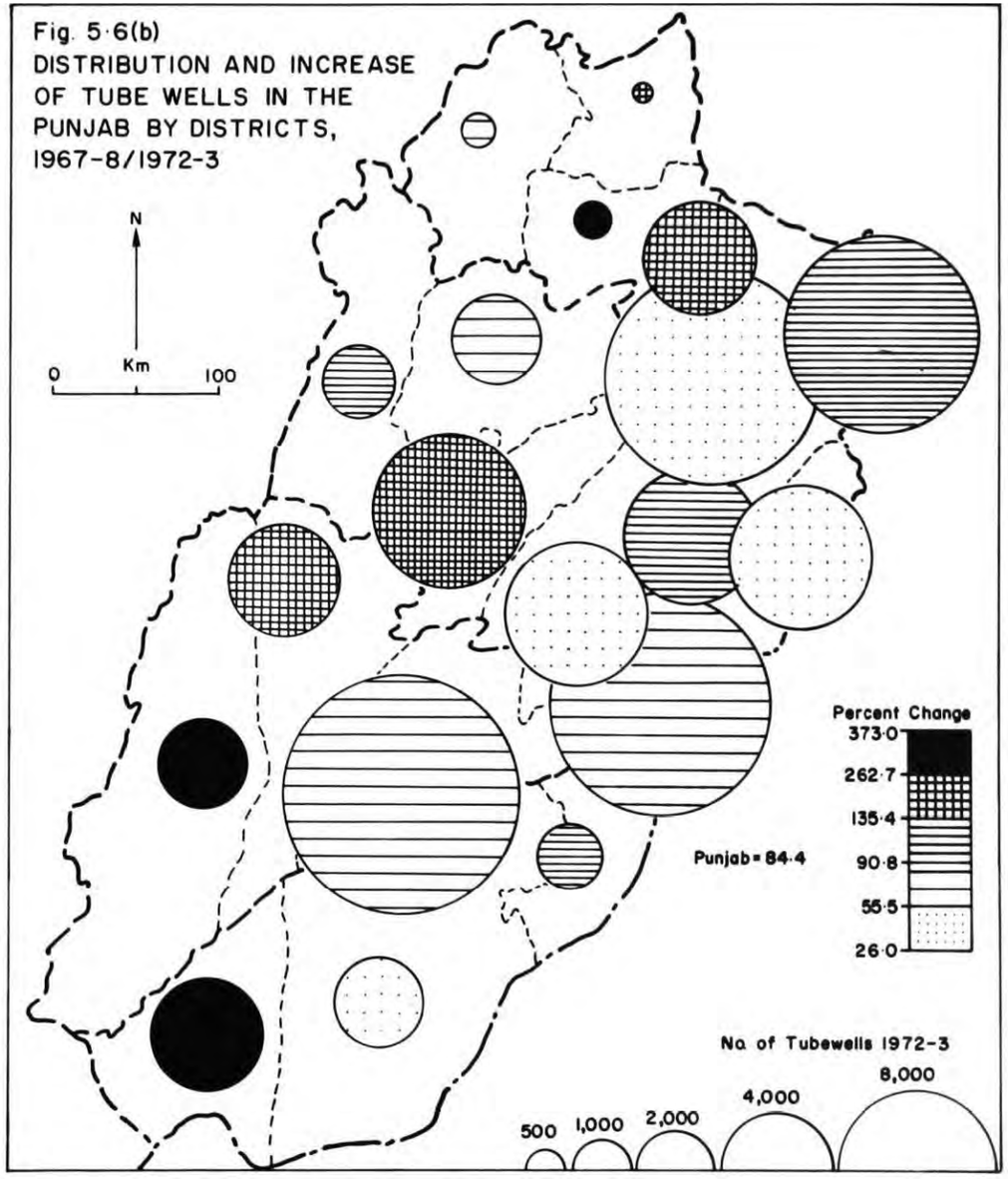


Fig. 5·6(b)
DISTRIBUTION AND INCREASE
OF TUBE WELLS IN THE
PUNJAB BY DISTRICTS,
1967-8/1972-3
N
0
Km
100
Percent Change
373·0
262·7
135·4
90·8
55·5
26·0
Punjab = 84·4
No. of Tubewells 1972-3
500
1,000
2,000
4,000
8,000

the southern trans-Indus and trans-Sutlej districts. During the five year period 1967-8/1972-3, the number of tube wells in the Punjab as a whole increased by 84.4 per cent from 58,780 to 108,389 while nine districts experienced over 100 per cent increases in their tube wells (Fig.5.6 (b)). The enhanced water supply together with high yielding seeds, mechanical implements and increaseduse of chemical fertilizer and pesticides provided a great stimulus to the Province's agriculture.

5.5.4. Cropping Patterns

The proportions of areas under different crops have shown slight variation from year to year but generally the foodgrains have remained dominant by occupying more than half of the total cropped area. Consisting mainly of wheat and rice but including maize, jowar, bajra and barley, the foodgrains occupied 56.3 per cent of Pakistan's total cropped area between 1948-9 and 1952-3, 53.3 per cent during the period 1958-9/1962-3 and 55.5 per cent between 1970-1 and 1974-5. Cash crops - cotton, sugarcane and tobacco-occupied 11.6, 12.1 and 15.2 per cent respectively during the three periods and the pulses between 8 and 10 per cent.

In the Punjab, the foodgrains occupied 53.7, 52.5 and 52 per cent of the total cropped area during the three above mentioned periods while cash crops occupied 12.2, 13.1 and 16.6 per cent respectively. Figure 5.7 indicates the variation of cropping pattern in the Punjab at the district level. The differences in the cropping patterns reflect an interplay of a multitude of factors including physical influences such as climate and soils and socioeconomic factors such as tradition, technology and farmer's economic status and attitude. In fact, governmental incentives notwithstanding, the decision about what crops to grow rests with the farmer. Thus, even within the same district there are considerable differences in the types of crops grown. As Johnson (1979) has very aptly pointed out :

> "Ultimately the decision about what crops to grow, whether one or several, rests with the farmer. He has to balance in his mind such diverse factors as the short term needs for food for his family, of cash to buy essentials or to spend on a coming marriage, his perception of the climatic environment matched with his expectations from the Irrigation Department with regard to canal or tube well water supplies, his knowledge of the alternatives open to him, of HYV and of their needs, for example, and his reading of the current straws in the wind indicative of movements in price and demand in distant markets." (14)

Thus any map showing cropping patterns at, say, the district level, inevitably involves sweeping generalizations. It does, nonetheless, help in understanding the regional variation in the relative importance of various crops. As Figure 5.7 shows, in 11 of the Punjab's districts foodgrains occupy over one half of the total cropped area. The predominance of foodgrains is generally higher in the north and declines towards the drier south where, under a more severe "threat" of aridity but with plentiful irrigation water, cotton takes up a sizeable share of the cropped area. While sugarcane is important in Lyallpur, Gujrat and Rahimyar Khan by occupying 11.5, 5.4 and 5.3 per cent of the total cropped areas respectively, pulses (gram, masoor, moong and mash) take up the largest share of the total cropped area in Mianwali and Sargodha, 45 and 22 per cent respectively. It is, therefore, evident that cereals and pulses predominate in crop areas followed by cash crops. The remaining area is taken up by oil seeds, vegetables, fruit and fodder. In terms of seasons, keeping aside the area under fruit, rabi or winter crops such as wheat, barley, tobacco and rabi pulses occupy about 60 per cent of the Punjab's cropped area in a normal year, while kharif or summer crops including rice, cotton, sugarcane, maize, jowar, bajra and kharif pulses occupy the rest - 40 per cent.

As explained above, the cropping patterns are influenced by a myriad of factors, physical as well as socioeconomic. On the urban fringes, for instance, the cropping patterns are distinctly different from elsewhere and the replacement of the conventional crops by the more commercial - vegetables, fodder and fruit - underscores the importance of marketing. Such changes are more obvious near large urban agglomerations.

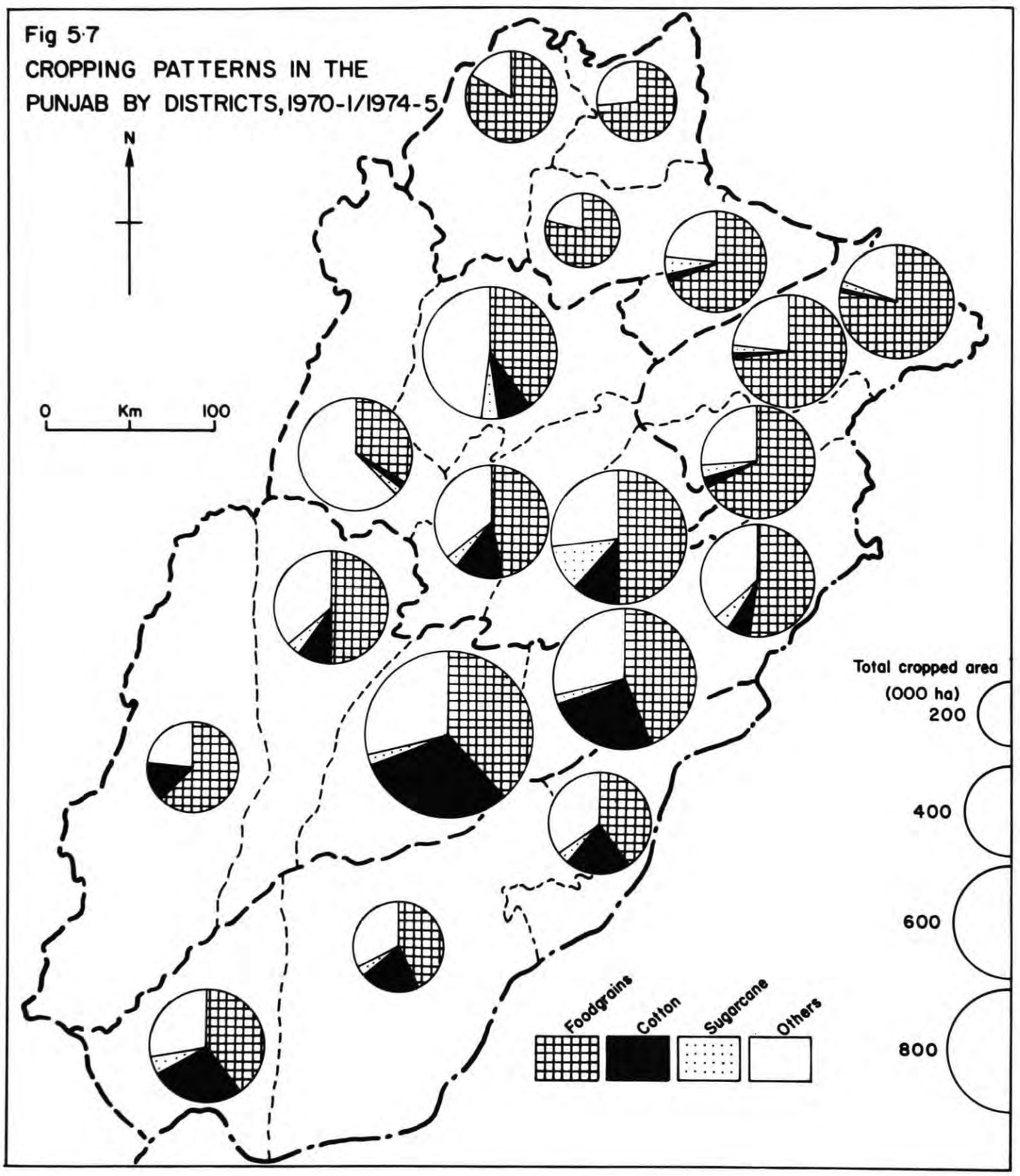


Fig 5·7
CROPPING PATTERNS IN THE
PUNJAB BY DISTRICTS, 1970-1/1974-5
N
0
Km
100
Total cropped area
(000 ha)
200
400
600
800
Foodgrains
Cotton
Sugarcane
Others

For almost two decades after Independence, the proportion of Pakistan's cropped land devoted to cotton remained almost unchanged or even declined despite considerable increases in the area under most other crops. In the Punjab, for instance, the cotton area actually declined in the Campbellpur, Lyallpur, Lahore, Sialkot and Sheikhupura districts between 1948-9/1952-3 and 1958-9/1962-3 and, as a result, the share of cotton area in the Province's total cropped dropped from 10.3 to 9.5 per cent. This happened despite considerable increases in the area under most other crops particularly rice and sugarcane (Appendices XVII-XVIII). Mohammad (1963) investigated this striking change in the region's cropping pattern and produced three conclusions. First, that the stagnation or decline in the cotton area in the Punjab's old canal colonies, particularly the districts with perennial irrigation such as Lyallpur, Sargodha, Jhang, Lahore, Gujranwala and Sheikhupura, was due to a rise in their water table resulting in waterlogging which made it physically more difficult and economically less advantageous to grow cotton. Second, that the extension of rice cultivation in areas served by perennial canals completely eliminated the cotton crop after some time. This was partly because rice could withstand waterlogging conditions better than any other crop and also because of economic incentives resulting from the government's policy, since 1959-60, of procuring the total marketable rice crop for export. A third conclusion of the same study was that, in the areas clear of waterlogging, sugarcane, because of its higher economic profitability, was fast replacing cotton as a cash crop. (15)

It is clear from the above that the areal and temporal changes in the region's cropping pattern are effected by physical as well as economic factors. As described in the last section, one of the most significant changes Pakistan's agriculture experienced was the increased water supply through the installation of private tube wells in the early 1960's. This event enabled the farmers to intensify irrigation and make significant changes in cropping patterns. In a pioneer study, Mohammad (1965) looked into the expansion of private tube wells and the cropping patterns in the area. According to this study, additional water

yielded by the tube wells enabled the farmers to : "i) increase the depth of irrigation for existing crops; ii) increase the intensity of cropping by eliminating fallowing and by double cropping; iii) grow more valuable crops like cotton, rice, fruits and vegetables; iv) increase the use of fertilizer; v) increase the efficiency of bullock use; and vi) increase the output per manual worker".(16) An important conclusion of this study was that, given the adequate water supply through tube wells, the area under kharif crops rose more sharply than that under rabi crops, with the largest increase in the area under cotton and rice, since these were valuable foreign exchange earners. Thus the Punjab's cropping pattern witnessed a significant change and the cotton area, which had seen a decline in its share of the total cropped from 10.3 per cent in 1948-9/1952-3 to 9.5 in 1958-9/1962-3, regained its importance by rising to 12.7 per cent between 1970-1/1974-5. The share of the area under rice during the three periods in question was 4, 5.4 and 6.4 per cent and that of sugarcane, 1.9, 3.5 and 3.7 per cent.

In a subsequent study, the output effects of tube wells on the Punjab's agriculture were investigated. It was noted that, while the enhanced water supply generally caused a significant increase in the area under cotton, sugarcane, rice and wheat; there was a decrease in the cotton area in the rice producing districts such as Gujranwala, Sialkot, Lahore, and Sheikhupura,since rice provided comparatively greater returns per hectare than cotton as soon as additional water became available. (17) Thus, a significant change took place in the cropping pattern of these districts with a fast diversion of cotton area by rice because of cotton's yield disadvantage and government's price-support policy for foodgrains. As a result, the share of cotton area in the total cropped declined from 5.4 to 2.1 per cent in Gujrat; 10 to 7.8 in Sargodha; 8 to 6.8 in Lahore; 1.8 to 0.9 in Sialkot; 2.8 to 1.6 in Gujranwala; and 5.6 to 3.1 per cent in Sheikhupura, between 1958-9/1962-3 and 1970-1/1974-5. Correspondingly, the share of area under rice climbed from 6.7 to 7.9 per cent in Gujrat; 1.4 to 2.7 in Sargodha; 6.6 to 10.6 in Lahore; 20.2 to 23.8 in Sialkot; 29.3 to 30.2 in

Gujranwala; and 22.3 to 25.4 per cent in Sheikhupura, during the same period. In Gujrat and Sargodha, area under sugarcane also registered an appreciable increase in its share of the total cropped; 2.8 to 5.4 and 2.3 to 4 per cent respectively.

Both the above mentioned studies support the conclusion that the region's cropping patterns underwent a significant change under the influence of some physical and economic factors and although the increased water supply was the main vehicle of this change, economic incentives were not least important. In a recent study, it has been postulated that the spatial variation in the cropping pattern is also associated with the size of holding,and the share of each major crop i.e. wheat, cotton and sugarcane increases with the farm size;but that of rice remains unchanged. (18) However, based on cross-sectional data covering small parts of only five of the Punjab's districts, this statement is to be treated with caution.

The "Green Revolution" sowed the seeds of a change in the region's cropping pattern through, inter alia, a change in the farmers' attitudes. Although short lived in its dramatic effects, the "biological-hydrological-chemical" technology associated with the "Green Revolution" made the farmer somewhat market-conscious. Data are lacking but it can be asserted from observation that, although the farmer's decision about crops is still basically dictated by his immediate food needs and, to some extent, by the vagaries of nature, change in his attitude commanded by the market factor is taking place. As a result, there is a growing tendency towards raising commercial crops such as fruit, vegetables and fodder.

5.6. LEVEL AND TRENDS OF AGRICULTURAL CHANGE

A generalized picture of agricultural change in the Punjab since the turn of the twentieth century was given in Chapter II, where the growth in the cultivated and canal irrigated area of the Province in the context of British Punjab was highlighted (Section 2.8). Then in the succeeding chapter, the

present Punjab's agricultural growth in terms of the change in its total cultivated, net sown, total irrigated and canal irrigated areas since 1901, was discussed at length with a view to underscoring the interaction between the changes in the Province's agriculture and population for the various intercensal periods (Table 3.7).

With the advent of modern perennial irrigation technology, the Province became the subcontinent's main food-surplus region, so much so that its agricultural prosperity was regarded as a major guarantee for the newly independent Pakistan's economic survival. (19) Thus any economic plan of the independent Pakistan must have been based on the Punjab's ability to feed the country's growing population as well as to contribute significantly towards foreign exchange earning.

However, the Punjab's, or for that matter Pakistan's, agriculture made little contribution to the nation's economic development during the first decade after Independence. Indeed, during much of the 1950's, agriculture was, according to Papanek (1967), the sick man of Pakistan's economic development (20) and, since agriculture contributed roughly half of the country's GNP during that period and employed almost four fifths of its work force, it had a depressing effect on the nation's development effort.

Although the country's cultivated area as well as that under various crops increased, the output either remained the same, rose only slightly or actually declined. This was particularly true of food crops which experienced marked decline in total output as well as in yield. In wheat, for instance, the yield per ha. dropped from 8.5 qu. in 1948-9/1952-3 to 8.2 qu. in 1958-9/1962-3 in the country as a whole and from 9.3 to 8.7 in the Punjab (Table 5.17). The result was that, during the period 1951-61, while the country's population climbed by 28.1 per cent, its value added in agriculture at the constant factor cost of 1959-60 rose by less than half as much - 13.7 per cent (Table 3.11) and the total food grain production by 14.2 per cent.

In the Punjab, which should normally not only be self-sufficient but also able to supply food to other provinces, the population during this period increased by 23.4 per cent; while the total cultivated and net sown areas rose by 9.9 and 12.8 per cent respectively and the total foodgrain production by only 10.8 per cent. As a result, the Province's per capita cultivated area dropped from 0.44 to 0.39 ha. and foodgrain availability from 185 to 166 kg.

To establish facts on a country's agricultural performance is not easy. However, most of Pakistan's initial agricultural difficulties were traceable to the social and political problems linked with Partition, particularly the restricted canal water supply. Not least important were the primitive technology and the vagaries of nature such as the capricious rainfall, floods, soil erosion, locusts, pests and diseases. But, if the 1950's were marked by a great instability in Pakistan's agriculture reflected in low levels of crop production and yields, the 1960's were characterized by a change when the uncertainty resulting from aridity and variability of rainfall was reduced by the development of ground water irrigation and regulation of canal water supply as a result of the Indus Waters Treaty.

Between 1958-9/1962-3 and 1970-1/1974-5, Pakistan's total cultivated, total cropped and total irrigated areas rose by 10.3, 14 and 21.5 per cent and those under total foodgrains, wheat and rice by 18.4, 22.3 and 29 per cent respectively. As a result, the total foodgrain production jumped by 82.2 per cent and that of wheat and rice by 88.1 and 122.7 per cent respectively. The corresponding figures for these productions during the previous period were 14.2, 12.7 and 31.1 (Appendices XI - XIII). Thus, whereas the country's population rose by 52.2 per cent between 1961 and 1972, its food production increased by more than one and a half times as much and the value added in agriculture by 66.6 per cent. The availability of foodgrain per head of total population, which had declined from 162 to 144 kg. during the 1950's, rose to 173 in the early 1970's.

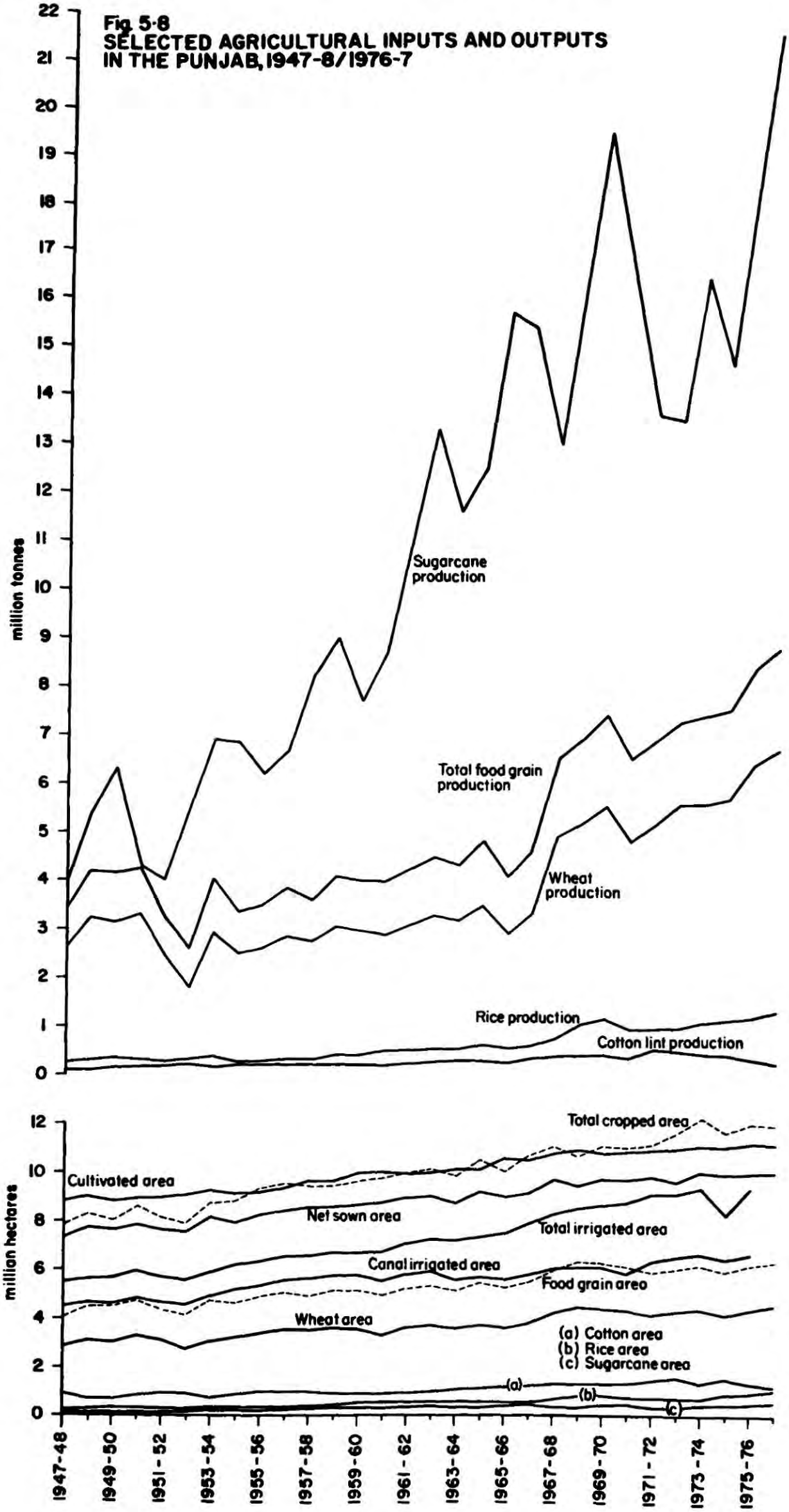
In the Punjab, the performance of agriculture during the 1960's was not

less impressive than in the country as a whole and between 1958-9/1962-3 and 1970-1/1974-5, the Province's total cultivated, total cropped and total irrigated areas increased by 11, 19.2 and 29.6 per cent respectively and those under total foodgrains, wheat and rice by 18.6, 20.9 and 42.8 per cent. This resulted in increases of 78.3, 83.5 and 125.1 per cent in the total production of foodgrains, wheat and rice respectively and 35 kg. in foodgrains per capita, from 166 to 201.

In order to have a closer look at the changes in the region's agriculture during the two decades after Independence, it is appropriate at this stage to define the measures of change. Areas, productions and average yields per ha. of total foodgrains, wheat, rice and sugarcane for Pakistan and its provinces for the period 1948-9/1952-3 to 1970-1/1974-5 are given in Appendices XI-XV. As already indicated, the Punjab leads the provinces by producing 76.6 per cent of the country's wheat, 46.3 per cent of its rice, 66.9 per cent of its total foodgrains, 71.4 per cent of its cotton and 69.9 per cent of its sugarcane (Table 5.3). However, in terms of yields per ha, the Punjab is relegated to the second position by Sind which, with a higher percentage of canal irrigated agriculture, has a slightly better land productivity. There is a pronounced difference between the irrigated and barani agriculture characterized by the higher crop production and land productivity in the former. In the Punjab, 78 per cent of the total cropped area is irrigated compared with Sind's 84.4 (Appendix IX) and although the Punjab's irrigated districts, particularly those in the Rechna and Bari doabs, have a higher land productivity than their counterparts in Sind, in the overall provincial averages the Punjab is surpassed by Sind.

The change in the Punjab's agriculture on a provincial basis is succinctly depicted by Figure 5.8, in which a number of the Province's agricultural inputs and outputs are charted on an annual basis from 1947-8 to 1976-7. The most conspicuous trends are : 1) the close association between the total foodgrains and wheat, demonstrated by the respective crop areas as well as productions - indicative of the high contribution of wheat in the region's total food output;

Fig. 5·8
SELECTED AGRICULTURAL INPUTS AND OUTPUTS IN THE PUNJAB, 1947-8/1976-7



2) parallel trends of the total irrigated and canal irrigated areas - showing the dominance of surface water resources in the total irrigation particularly before 1962-3, the trends started varying afterwards due to ground water exploitation; 3) the parallel trends between the total cultivated and the net sown areas indicative of a near-constant proportion of fallow; 4) the location of the line showing total cropped area between the net sown and total cultivated - although the total cropped area exceeded the net sown in all years, it was rarely in excess of the total cultivated before 1961-2. However the increased water supply thereafter, particularly in the late 1960's, boosted it via double cropping - indicative of a rising cropping intensity; and 5) the sharp rise in the crop productions after 1965-6, with the advent of the "Green Revolution" but the dramatic increase in the sugarcane output beginning in 1951-2, explicable mainly in terms of economic incentives offered by the rapidly growing sugar industry.

Taking into account the areas under different crops, production totals are low. Indeed, Pakistan's agriculture is characterized by, inter alia, very low land and labour productivity. Table 5.2 reveals that, although Pakistan, with 0.6 per cent of the world's surface area and 1.8 per cent of its population, produces 1.9 per cent of the world's wheat, 1.2 per cent of its rice, 4.5 per cent of its cotton and 3.9 per cent of its sugarcane, in most crops it has one of the lowest yields per ha. amongst the world's major agricultural countries. Similarly, although the Punjab's average yields in most crops are better than those of the country as a whole, it lags far behind the world averages. The level of labour productivity is not encouraging either. During the period 1948-9/1952-3, the Punjab had 1.9 ha. of net sown area per head of the agricultural labour force and produced 0.70 tonnes of wheat and 0.94 tonnes of total foodgrains per head. However, these averages had dropped to 1.82, 0.64 and 0.88 respectively by the period 1958-9/1962-3 and to 1.1, 0.63 and 0.84 respectively by the quinquennium 1970-1/1974-5, underlining the lack of any substantial change as well as the disparity between the increase of crop output

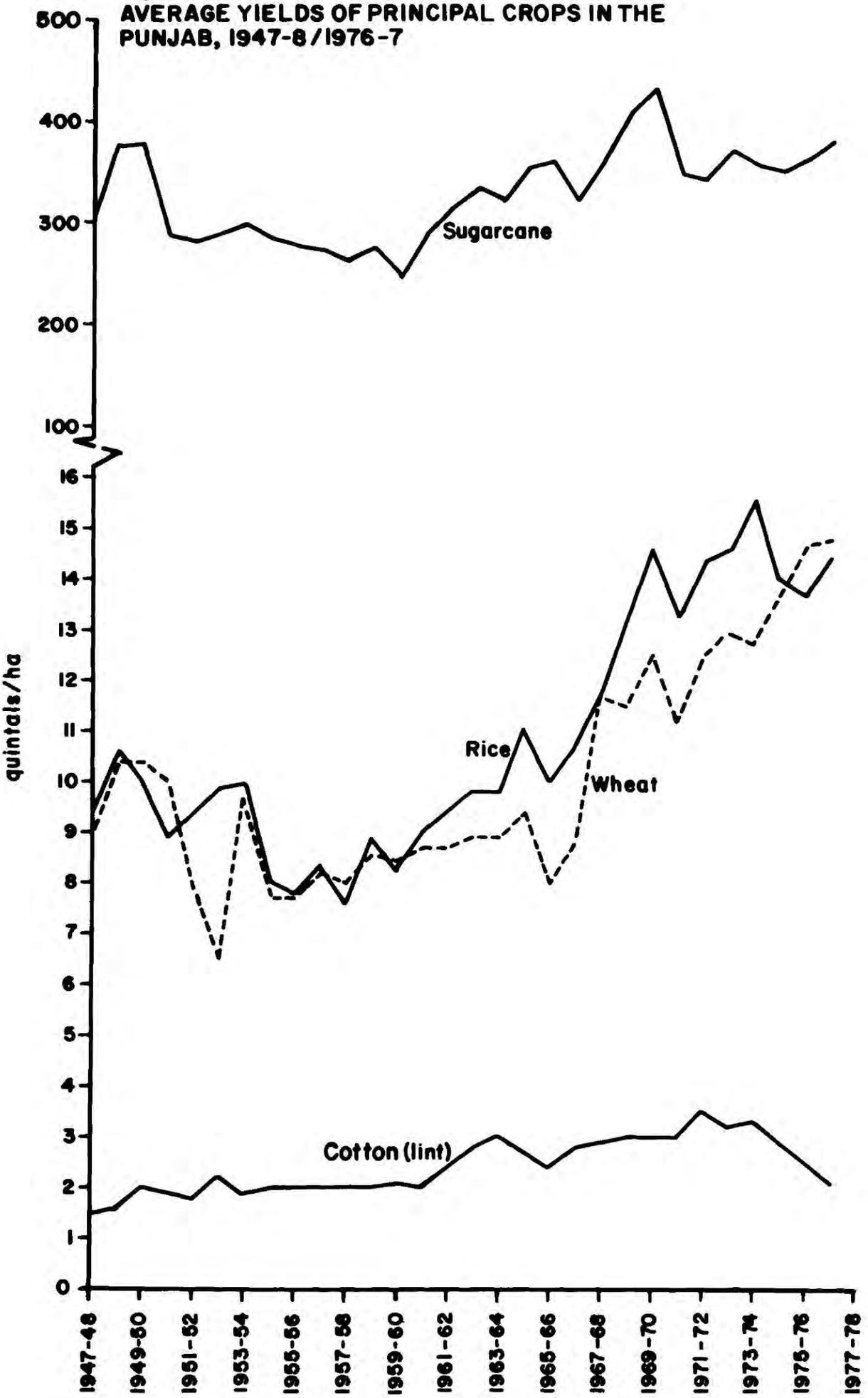
and the growth of agricultural labour force.

Figure 5.9 presents the average yearly yields of wheat, rice, cotton and sugarcane in the Punjab for the three post-Independence decades. It is evident that the yields of food crops touched their lowest levels in the early 1950's when the cash crops, in particular cotton, showed an increase. The crop yields recouped afterwards; however the most spectacular increases were experienced after 1965-6, coinciding with the increased and much more regulated water supply, greater application of chemical fertilizer and the introduction of high yielding seeds.

In order to substantiate the facts of agricultural change in the Punjab with an emphasis on the regional variations, but faced with the great bulk of the data available, a selection of variables is inevitable at this stage. Thus, net sown area, since it occupies the focal position in the agricultural areas, and cropping intensity because it reflects the region's effort of vertical development of agriculture, have been selected. From crops, the choice is made of wheat, the principal foodgrain; and cotton, the conventional cash crop; which represent the rabi and kharif seasons respectively.

Wheat is Pakistan's most important crop, occupying 34.7 per cent of the country's total cropped area, 62.6 per cent of its area under foodgrains and almost three fourths of the rabi crop area. Being the most important food crop, it not only provides almost two thirds of the total calorie intake, but determines the country's overall food situation and thus influences the national economy directly and indirectly. In addition, its price has a great bearing upon the general price level and thus, to a great extent, on the cost of living. In the Punjab, it is a universal crop and dominates the rabi cropping pattern. It occupies 36.7 per cent of the Province's total cropped area, 70.5 per cent of its area under foodgrains and 77.3 per cent of the total rabi area; and accounts for 75.6 per cent of the Province's total foodgrain production.

Fig. 5·9
AVERAGE YIELDS OF PRINCIPAL CROPS IN THE PUNJAB, 1947-8 / 1976-7



Cotton is Pakistan's most important cash crop, occupying 11.4 per cent of the total cropped and 27.8 per cent of the total kharif area. (21) Although its principal competitor, sugarcane, has made great strides since 1951-2 (Fig.5.8), almost the entire output of the latter is consumed at home. Cotton, on the other hand, not only feeds the country's growing textile industry but also produces a major part of its foreign exchange. Between 1974-5 and 1976-7, for instance, the exports of cotton and cotton manufactures earned on the average Rs.3,577 million per year or almost one third of total export earnings. (22) In cotton production, Pakistan ranks fifth in the world after the USSR, China, the USA and India (Table 5.2) and the Punjab produces 71.4 per cent of the country's cotton on 76.7 per cent of its cotton area. In the Province, cotton area constitutes 12.7 per cent of the total cropped and 32.7 per cent of the kharif area.

Let us now examine the level of the Punjab's agricultural change since Independence, in terms of the above mentioned indices. The areas, productions and yields per ha. of wheat and cotton in the Punjab's divisions and districts are given in Tables 5.11 and 5.12 respectively. Similar data for the total foodgrains, rice and sugarcane are given in Appendices XVI-XVIII. The changes in the net sown areas and cropping intensity for the districts are mapped in Figure 5.10, those in the wheat and cotton areas and productions in Figures 5.11 and 5.12 respectively. The yields per ha. of wheat and cotton for the three years in question are portrayed in Figure 5.13.

Between 1950-1 and 1960-1, the value added in agriculture increased by 13.7 per cent at an average annual rate of 1.3 per cent but that of major crops by less than 9 per cent at less than 0.9 per cent annual average. As a result, the share of major crops in the agricultural sector dropped from 52.1 to 49.9 per cent. The stagnation in the region's agriculture during the 1950's is not reflected so much by the slow increase in the net sown area nor by slowly mounting cropping intensity as by a sharp decline in the crop areas, productions and yields. While the Punjab's overall net sown area increased by almost 13 per cent, in Mianwali, Jhang and

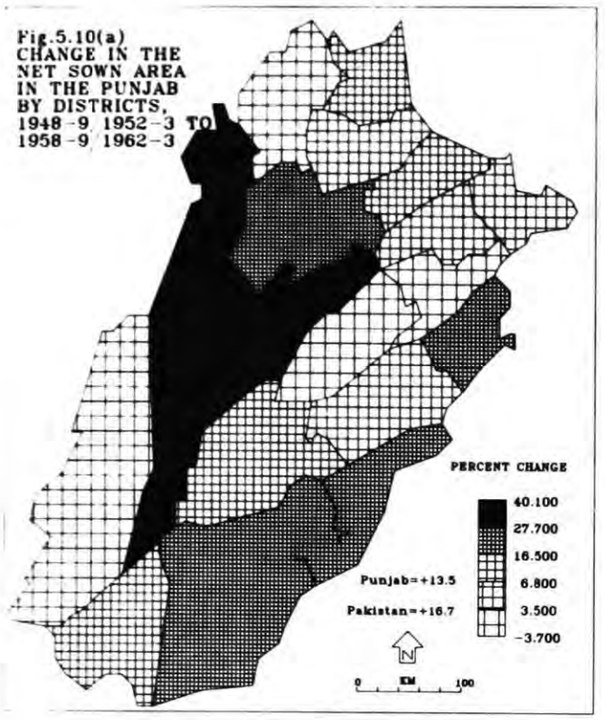


Fig.5.10(a)
CHANGE IN THE
NET SOWN AREA
IN THE PUNJAB
BY DISTRICTS,
1948-9 1952-3 TO
1958-9 1962-3
PERCENT CHANGE
40.100
27.700
16.500
6.800
3.500
-3.700
Punjab=+13.5
Pakistan=+16.7
N
0 KM 100

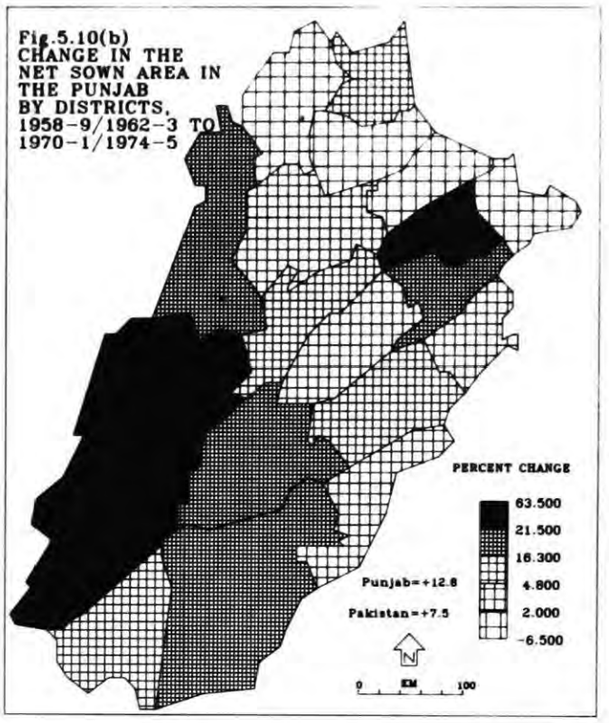


Fig.5.10(b)
CHANGE IN THE
NET SOWN AREA IN
THE PUNJAB
BY DISTRICTS,
1958-9/1962-3 TO
1970-1/1974-5
PERCENT CHANGE
63.500
21.500
16.300
4.800
2.000
-6.500
Punjab=+12.8
Pakistan=+7.5
N
0 KM 100

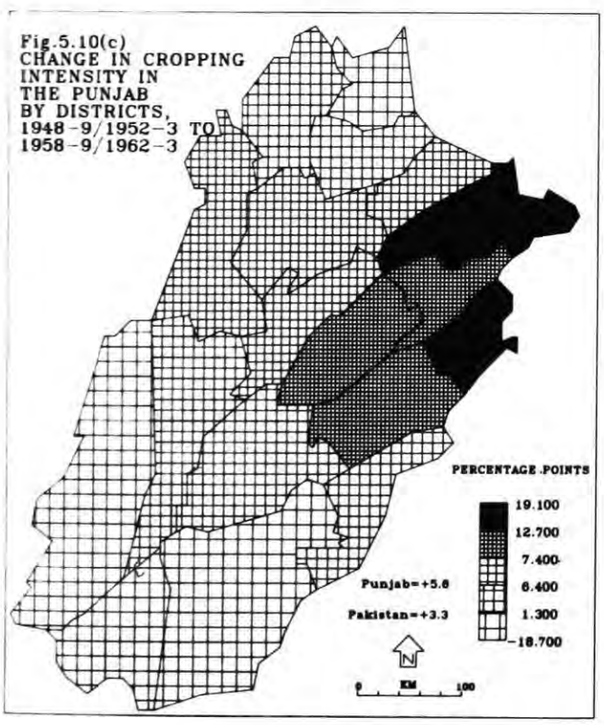


Fig.5.10(c)
CHANGE IN CROPPING
INTENSITY IN
THE PUNJAB
BY DISTRICTS,
1948-9/1952-3 TO
1958-9/1962-3
PERCENTAGE POINTS
19.100
12.700
7.400
6.400
1.300
-18.700
Punjab=+5.6
Pakistan=+3.3
N
0 KM 100

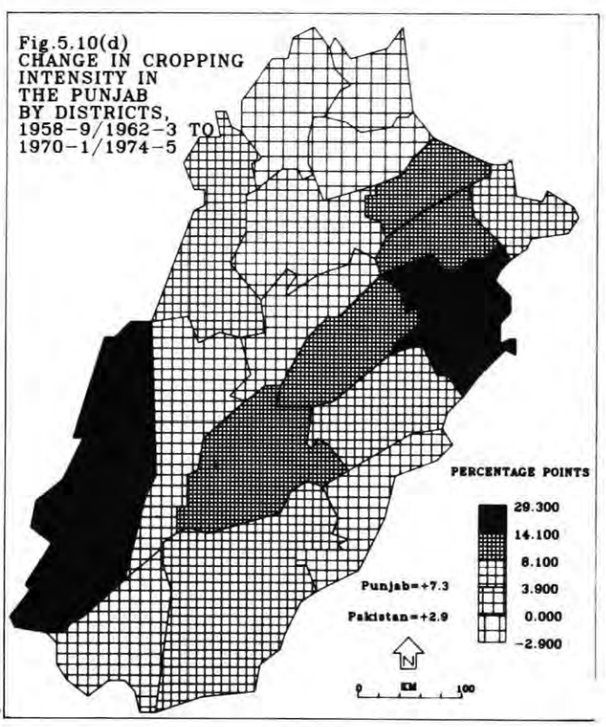


Fig.5.10(d)
CHANGE IN CROPPING
INTENSITY IN
THE PUNJAB
BY DISTRICTS,
1958-9/1962-3 TO
1970-1/1974-5
PERCENTAGE POINTS
29.300
14.100
8.100
3.900
0.000
-2.900
Punjab=+7.3
Pakistan=+2.9
N
0 KM 100

TABLE 5.11

AREA, PRODUCTION AND YIELD OF WHEAT, THE PUNJAB, DIVISIONS AND DISTRICTS, 1951-72

Division/District	Area 000 ha			% Change			Production 000 tonnes			% Change			Yield quint/ha		
	1951	1961	1972	1951-61	1961-72	1951-72	1951	1961	1972	1951-61	1961-72	1951-72	1951	1961	1972
I. RAWALPINDI DIV.	642	703	733	9.5	4.3	14.2	414	445	428	7.5	-3.8	3.4	6.4	6.3	5.8
1. RWP	102	121	130	18.6	7.4	27.5	63	67	66	6.3	-1.5	4.8	6.2	5.5	5.1
2. CPR	245	253	254	3.3	0.4	3.7	123	143	118	16.3	-17.5	-4.1	5.0	5.7	4.6
3. JLM	134	147	138	9.7	-6.1	3.0	89	100	70	12.4	-30.0	-21.3	6.6	6.8	5.1
4. GJT	161	182	211	13.0	15.9	31.1	139	135	174	-2.9	28.9	25.2	8.6	7.4	8.2
II. SARGODHA DIV.	793	909	1,054	14.6	16.0	32.9	827	853	1,574	3.1	84.5	90.3	10.4	9.4	14.9
5. SRG	213	244	280	14.6	14.8	31.5	220	227	402	3.2	77.1	82.7	10.3	9.3	14.4
6. MWI	140	182	200	30.0	9.9	42.9	82	96	189	17.1	96.9	130.5	5.9	5.3	9.4
7. JNG	164	177	225	7.9	27.1	37.2	168	159	331	-5.4	108.2	97.0	10.2	9.0	14.7
8. LYP	276	306	349	10.9	14.1	26.4	357	371	652	3.9	75.7	82.6	12.9	12.1	18.7
III. LAHORE DIV.	562	623	866	10.9	39.0	54.1	505	486	1,084	-3.8	123.0	114.7	9.0	7.8	12.5
9. LHR	87	126	196	44.8	55.6	125.3	75	110	262	46.7	138.2	249.3	8.6	8.7	13.4
10. SLT	179	191	230	6.7	20.4	28.5	151	130	240	-13.9	84.6	58.9	8.4	6.8	10.4
11. GWA	149	157	234	5.4	49.0	57.0	131	124	318	-5.3	156.5	142.7	8.8	7.9	13.6
12. SHA	147	149	206	1.4	38.3	40.1	148	122	264	-17.6	116.4	78.4	10.1	8.2	12.8
IV. MULTAN DIV.	792	970	1,245	22.5	28.4	57.2	892	976	2,082	9.4	113.3	133.4	11.3	10.1	16.7
13. MTN	323	391	460	21.1	17.6	42.4	392	460	825	17.3	79.3	110.5	12.1	11.8	17.9
14. SWL	241	283	370	17.4	30.7	53.5	297	305	696	2.7	128.2	134.3	12.3	10.8	18.8
15. MZG	145	188	279	29.7	48.4	92.4	132	135	397	2.3	194.1	200.8	9.1	7.2	14.2
16. DGK	83	108	136	30.1	25.9	63.9	71	76	164	7.0	115.8	131.0	8.6	7.0	12.1
V. BAHAWALPUR DIV.	293	376	433	28.3	15.2	47.8	224	354	545	58.0	54.0	143.3	7.6	9.4	12.6
17. BWP	78	99	123	26.9	24.2	57.7	48	100	151	108.3	51.0	214.6	6.2	10.1	12.3
18. BWN	102	131	147	28.4	12.2	44.1	63	117	181	85.7	54.7	187.3	6.2	8.9	12.3
19. RYK	113	146	163	29.2	11.6	44.2	113	137	213	21.2	55.5	88.5	10.0	9.4	13.1
PUNJAB	3,082	3,581	4,331	16.2	20.9	40.5	2,862	3,114	5,713	8.8	83.5	99.6	9.3	8.7	13.2

NOTES AND SOURCES : As in Table 5.6

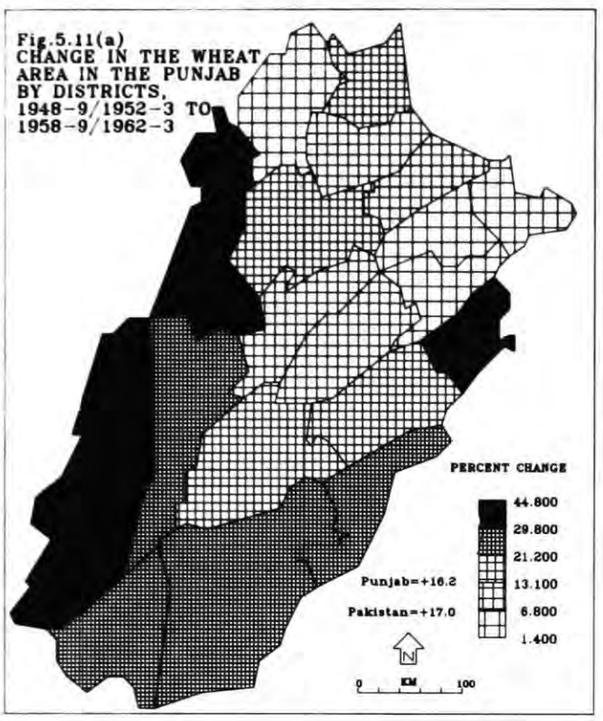


Fig.5.11(a)
CHANGE IN THE WHEAT AREA IN THE PUNJAB BY DISTRICTS, 1948-9/1952-3 TO 1958-9/1962-3

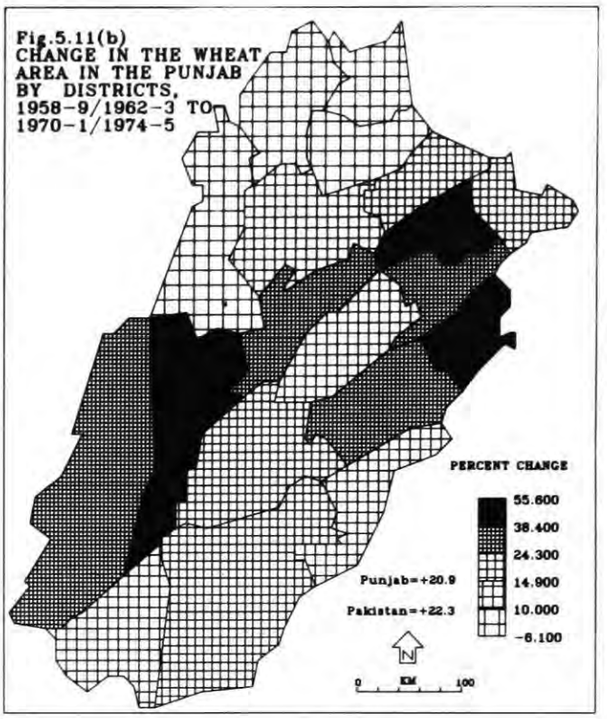


Fig.5.11(b)
CHANGE IN THE WHEAT AREA IN THE PUNJAB BY DISTRICTS, 1958-9/1962-3 TO 1970-1/1974-5

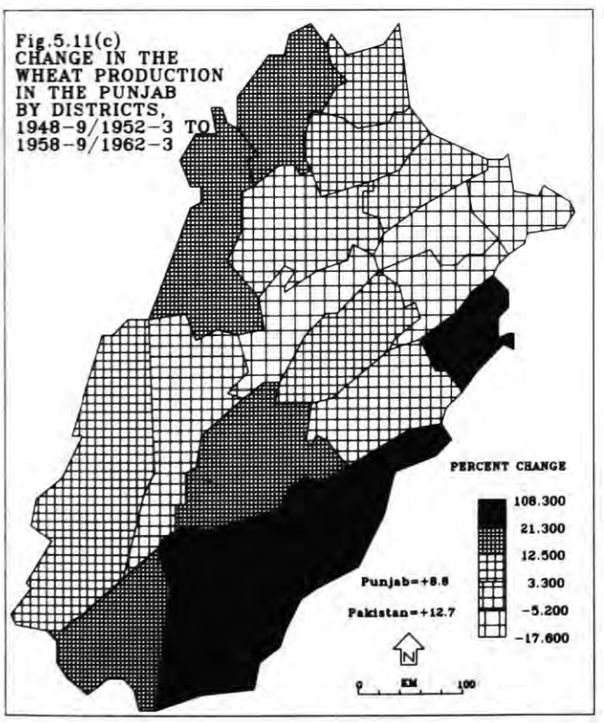


Fig.5.11(c)
CHANGE IN THE WHEAT PRODUCTION IN THE PUNJAB BY DISTRICTS, 1948-9/1952-3 TO 1958-9/1962-3

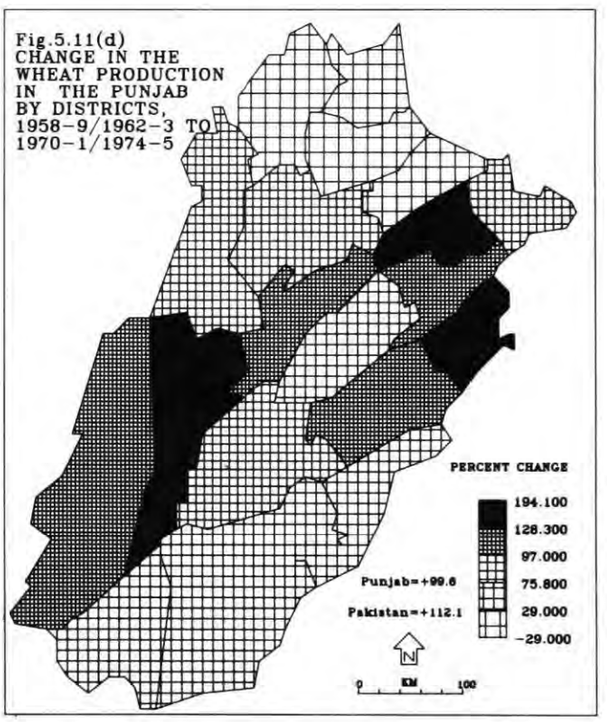


Fig.5.11(d)
CHANGE IN THE WHEAT PRODUCTION IN THE PUNJAB BY DISTRICTS, 1958-9/1962-3 TO 1970-1/1974-5

Muzaffargarh districts, the increases were above 33 per cent - attributed to the newly developed canal irrigation from the Jinnah and Taunsa barrages. Only two districts - Sheikhupura and Lyallpur - experienced declines due mainly to water-logging and salinity.

In cropping intensity too, the Province experienced a moderate increase of 5.6 percentage points - compared with the country's 3.3 - and the heavily populated and fast urbanizing districts of Lahore, Gujranwala and Sialkot experienced increases of 19.1, 16.8 and 16.1 percentage points respectively. But in Bahawalpur and Rahimyar Khan, the interruption of canal water, due to the diversion of the Sutlej water by India, caused a decline in the cropping intensity. Dera Ghazi Khan increased its total cultivated area by 50.1 per cent but the net sown by only one fifteenth of that, since a high proportion of the cultivated area remained fallow due to water scarcity. Thus the district's cropping intensity declined by 18.7 percentage points (Fig. 5.10(c)).

In the crop areas and productions, however, the situation was different. While the wheat area in the Punjab as a whole rose by 16.2 per cent, wheat production increased by only half as much and the yield per ha. declined by over 6 per cent - from 9.3 to 8.7 qu/ha. In the districts, the picture was more depressing; while no district suffered from a decline in its wheat area - ten districts had, in fact, higher than the Provincial increase - in production five of them experienced decreases and in yield only five showed an increase (Table 5.11). Thus the production of wheat demonstrated a greater variation than its area. The variation in the wheat area is influenced by the availability of water through canals in the irrigated areas and late monsoon and early winter rains in the barani areas and also by the price situation of the competitive cash crops such as oilseeds in the preceding rabi or cotton in kharif. In production, on the other hand, although water remains a fundamental element, particularly during March-April, the crucial period of wheat growth, floods, pests and diseases, fertilizer use and type of seeds have a great bearing on the total output. During the year 1952-3, for

TABLE 5.12

AREA, PRODUCTION AND YIELD OF COTTON, THE PUNJAB, DIVISIONS AND DISTRICTS, 1951-72

Division/District	Area 000 ha			Area % Change			Production 000 tonnes			Production % Change			Yield quint/ha		
	1951	1961	1972	1951-61	1961-72	1951-72	1951	1961	1972	1951-61	1961-72	1951-72	1951	1961	1972
I. RAWALPINDI DIV.	28	28	12	0.0	-57.1	-57.1	4	5	3	25.0	-40.0	-25.0	1.4	1.8	2.5
1. RWP	0	0	0	-	-	-	0	0	0	-	-	-	-	-	-
2. CPR	2	1	0	-50.0	-	-	0	0	0	-	-	-	-	-	-
3. JLM	2	2	1	0.0	-50.0	-50.0	0	0	0	-	-	-	-	-	-
4. GJT	24	25	11	4.2	-56.0	-54.2	4	5	3	25.0	-40.0	-25.0	1.7	2.0	2.7
II. SARGODHA DIV.	234	225	269	-3.8	19.6	15.0	42	53	66	26.2	24.5	57.1	1.8	2.4	2.5
5. SRG	74	81	75	9.5	-7.4	1.4	14	19	18	35.7	-5.3	28.6	1.9	2.3	2.4
6. MWI	0	4	12	-	200.0	-	0	1	2	-	100.0	100.0	-	2.5	1.7
7. JNG	47	55	81	17.0	47.3	72.3	7	12	18	71.4	50.0	157.1	1.5	2.2	2.2
8. LYP	113	85	101	-24.8	18.8	-10.6	21	21	28	-	33.3	33.3	1.9	2.5	2.8
III. LAHORE DIV.	94	79	69	-16.0	-12.7	-26.6	13	15	12	15.4	-20.6	-7.7	1.4	1.9	1.7
9. LHR	42	34	37	-19.0	8.8	-11.9	5	6	6	20.0	-	20.0	1.2	1.8	1.6
10. SLT	11	9	5	-18.2	-44.4	-54.5	1	1	1	-	-	-	0.9	1.1	2.0
11. GWA	11	13	10	18.2	-23.1	-9.1	2	3	2	50.0	-33.3	-	1.8	2.3	2.0
12. SHA	30	23	17	-23.3	-26.1	-43.3	5	5	3	-	-40.0	-40.0	1.7	2.2	1.8
IV. MULTAN DIV.	344	393	812	14.2	106.6	136.0	67	100	289	49.3	189.0	331.3	1.9	2.5	3.6
13. MTN	197	240	422	21.8	75.8	114.2	39	61	163	56.4	167.2	317.9	2.0	2.5	3.9
14. SWL	123	128	273	4.1	113.3	122.0	24	35	98	45.8	180.0	308.3	2.0	2.7	3.6
15. MZG	16	17	63	6.3	270.6	293.8	3	3	16	-	433.3	433.3	1.9	1.8	2.5
16. DGK	8	8	54	0.0	575.0	575.0	1	1	12	-	1100.0	1100.0	1.3	1.3	2.2
V. BAHAWALPUR DIV.	167	209	338	25.1	61.7	102.4	32	46	94	43.8	104.3	193.8	1.9	2.2	2.8
17. BWP	23	26	80	13.0	207.7	247.8	3	5	21	66.7	320.0	600.0	1.3	1.9	2.6
18. BWN	44	56	110	27.3	96.4	150.0	7	11	28	57.1	154.5	300.0	1.6	2.0	2.5
19. RYK	100	127	148	27.0	16.5	48.0	22	30	45	36.4	50.0	104.5	2.2	2.4	3.0
PUNJAB	867	934	1,500	7.7	60.6	73.0	158	219	464	38.6	111.9	193.7	1.8	2.3	3.1

NOTES AND SOURCES : As in Table 5.6

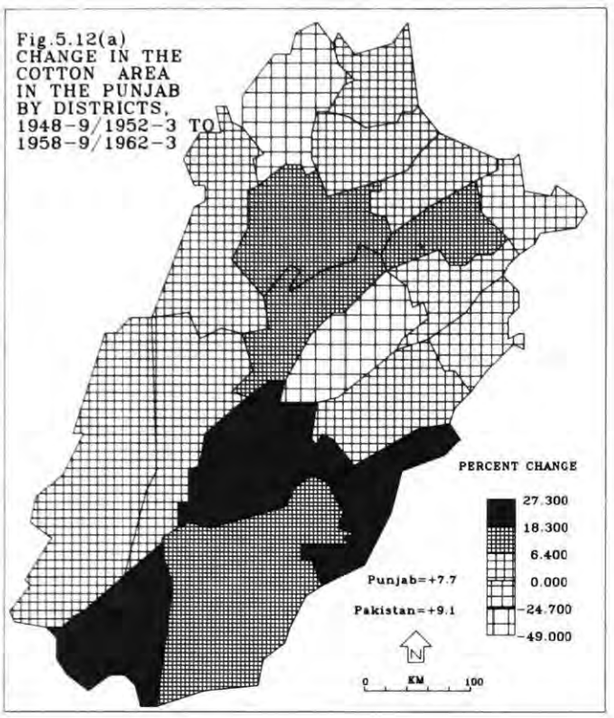


Fig.5.12(a)
CHANGE IN THE
COTTON AREA
IN THE PUNJAB
BY DISTRICTS,
1948-9/1952-3 TO
1958-9/1962-3
PERCENT CHANGE
27.300
18.300
6.400
0.000
-24.700
-49.000
Punjab=+7.7
Pakistan=+9.1
N
0 KM 100

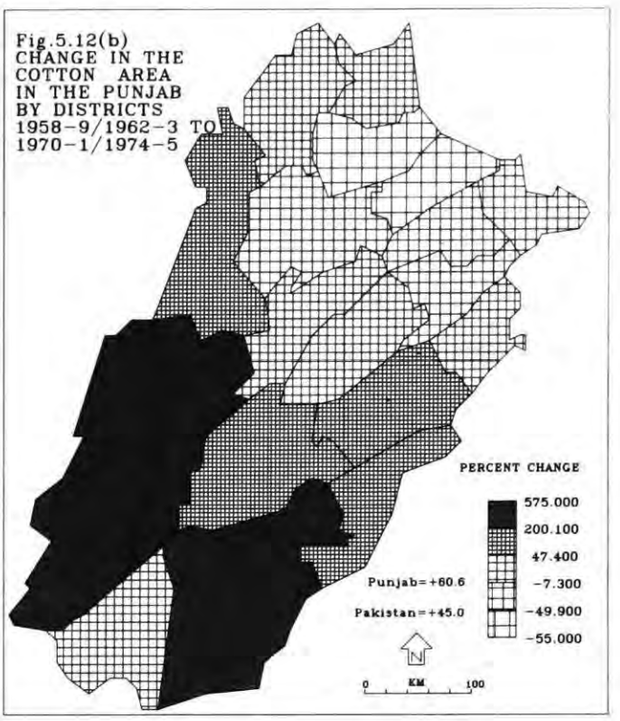


Fig.5.12(b)
CHANGE IN THE
COTTON AREA
IN THE PUNJAB
BY DISTRICTS
1958-9/1962-3 TO
1970-1/1974-5
PERCENT CHANGE
575.000
200.100
47.400
-7.300
-49.900
-55.000
Punjab=+60.6
Pakistan=+45.0
N
0 KM 100

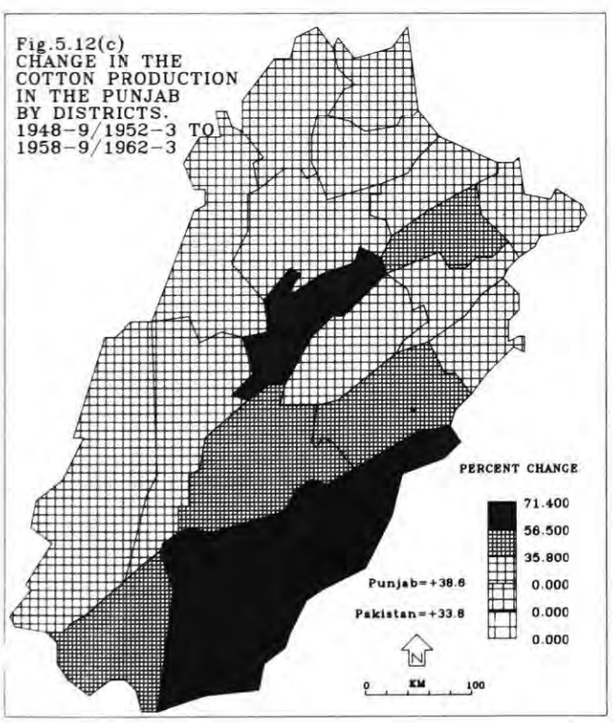


Fig.5.12(c)
CHANGE IN THE
COTTON PRODUCTION
IN THE PUNJAB
BY DISTRICTS.
1948-9/1952-3 TO
1958-9/1962-3
PERCENT CHANGE
71.400
56.500
35.800
0.000
0.000
0.000
Punjab=+38.6
Pakistan=+33.8
N
0 KM 100

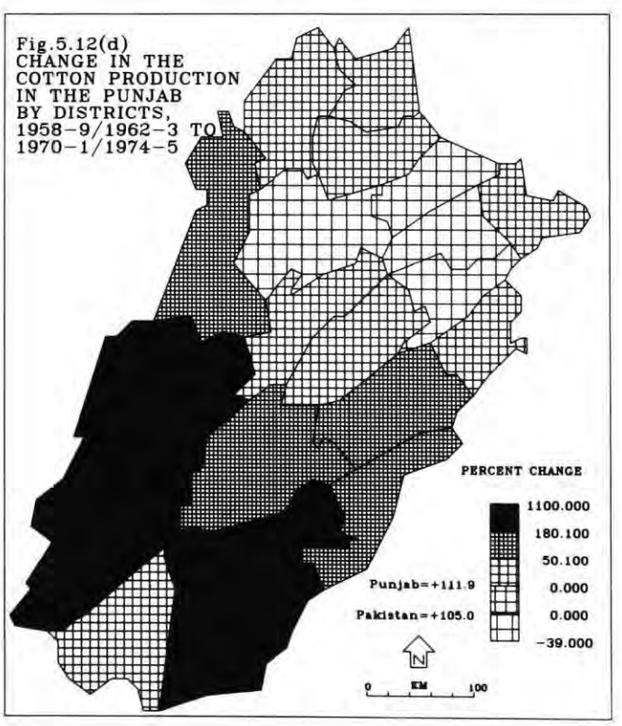


Fig.5.12(d)
CHANGE IN THE
COTTON PRODUCTION
IN THE PUNJAB
BY DISTRICTS,
1958-9/1962-3 TO
1970-1/1974-5
PERCENT CHANGE
1100.000
180.100
50.100
0.000
0.000
-39.000
Punjab=+111.9
Pakistan=+105.0
N
0 KM 100

example, the decline in the wheat area was attributed to the diversion of some of it to the more profitable oilseeds and cotton. (23) In addition, a combination of all these factors caused a large decline in the wheat production.

In the case of cotton, the crop area in the Province as a whole rose by 7.7 per cent between 1948-9/1952-3 and 1958-9/1962-3,while production increased by five times as much and, although in five districts the area under cotton declined, production did not decrease anywhere (Table 5.12). The decline in the cotton area was experienced in Campbellpur, Lyallpur, Lahore, Sialkot and Sheikhupura districts where, due to a combination of waterlogging and economic considerations, the cotton area was diverted to other crops such as rice and sugarcane (Section 5.5.4). However, the main cotton producing districts - Multan, Sahiwal and Rahimyar Khan - together increased their cotton area by 17.9 per cent and production by 48.2 per cent during this period. As a result, their share in the Province's cotton area jumped from 48.4 to 53 per cent and that in production from 53.8 to 57.5 per cent.

The 1960's - in particular the latter half - created a markedly different picture in the region's agriculture. The most spectacular feature of the change was not the growth of the net sown area - for that increased at a slower rate than in the previous period - nor was the rise in the cropping intensity more impressive than in the last period, it was the momentous change in the crop areas, productions and yields. The Province's wheat area, production and yield rose by 20.9, 83.5 and 51.7 per cent respectively during the period 1958-9/ 1962-3 to 1970-1/1974-5 - the corresponding figures for the earlier period were 16.2, 8.8 and -6.5 per cent respectively (Table 5.11). Similarly in cotton, the area, production and yield rose by 60.6, 111.9 and 34.8 per cent respectively compared with the previous increases of 7.7, 38.6 and 27.8 per cent (Table 5.12) As a result, Pakistan's value added in agriculture increased by 66.6 per cent between 1960-1 and 1972-3 at an average annual rate of 4.3 per cent and that of major crops by 94.6 and 5.7 per cent respectively. Thus the major crops increased their share in the agriculture's value added from 49.9 to 58.3 per cent.

Fig 5·13(a)
YIELD PER HECTARE OF WHEAT IN THE PUNJAB BY DISTRICTS, 1948-9/1952-3 to 1970-1/1974-5

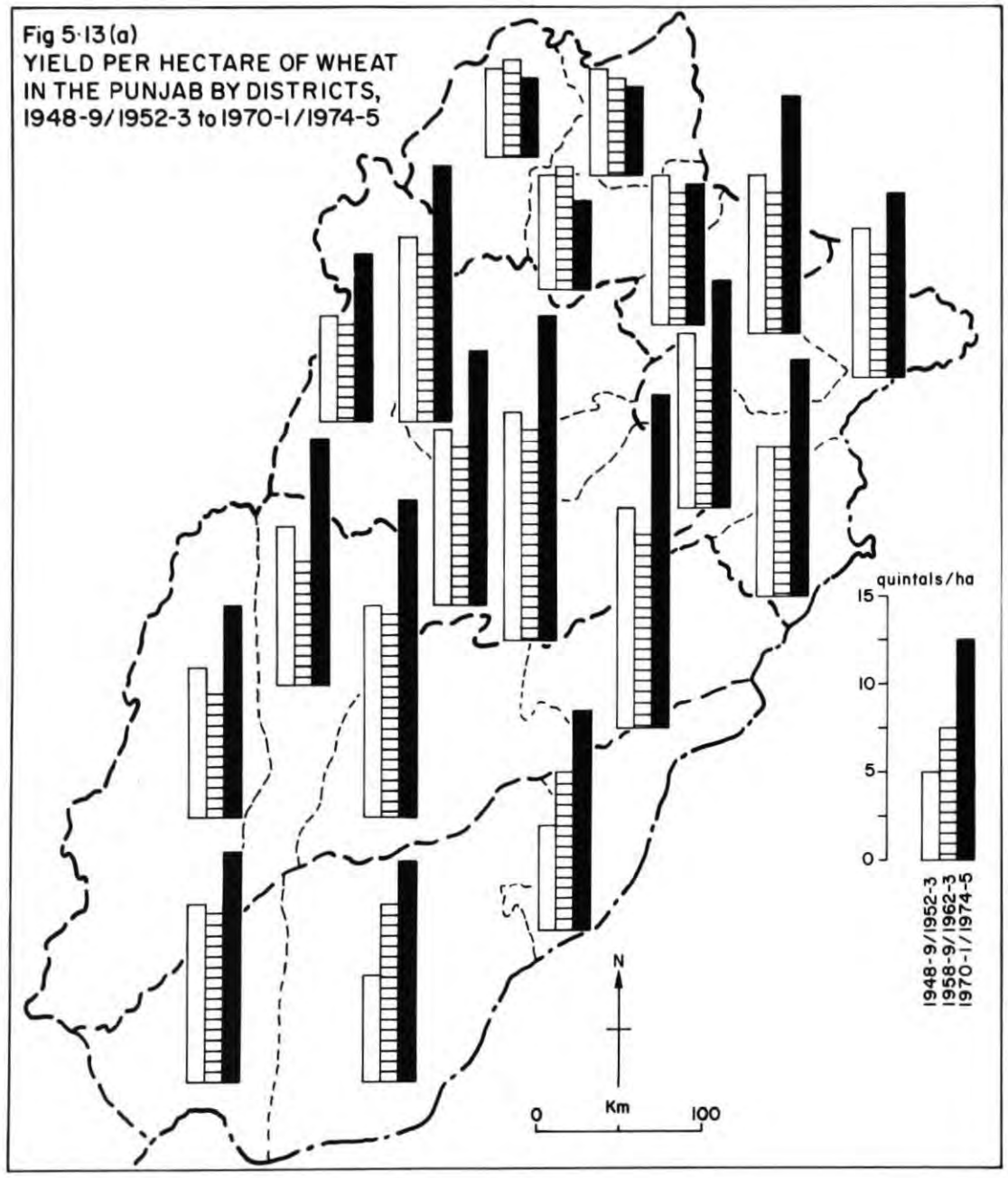
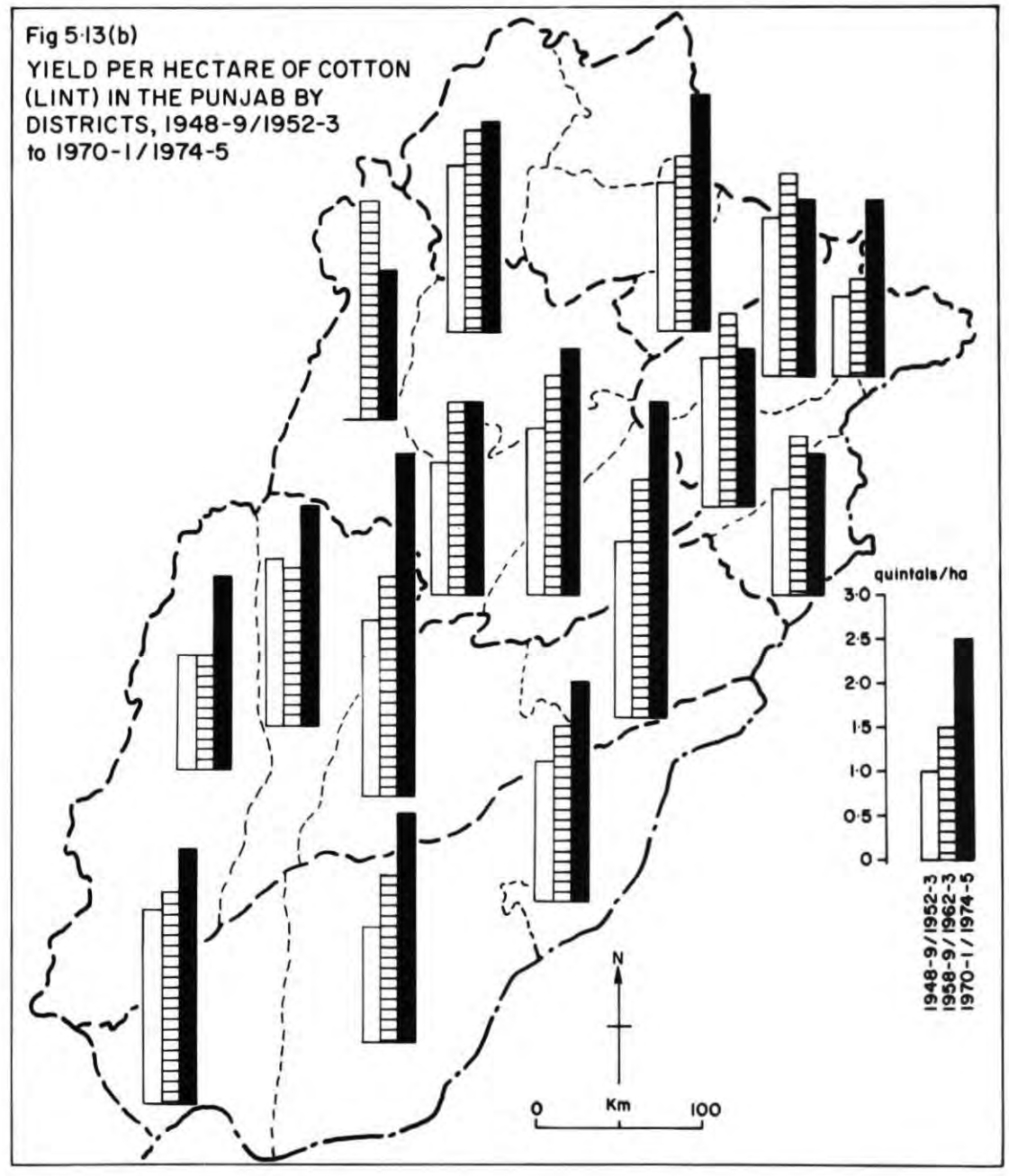


Fig 5·13(b)
YIELD PER HECTARE OF COTTON (LINT) IN THE PUNJAB BY DISTRICTS, 1948-9/1952-3 to 1970-1/1974-5



5.7. SOME DETERMINANTS OF AGRICULTURAL CHANGE

The limited contribution of Pakistan's agriculture to the national economy during the first post-Independence decade is attributed to the upheavals accompanying Partition. Not only were some important irrigation canals of the independent Pakistan severed from their headworks in India but the massive population transfer had also caused disruption of wells, homes, standing crops and irrigation ditches. In the pre-Partition days, the area forming Pakistan was the subcontinent's principal supplier of agricultural products and the populace in this part was overwhelmingly agricultural. Independence, however, diversified the occupational pattern by providing an opportunity to the people to engage in other callings such as commerce and industry. This resulted in a certain neglect of agriculture. In government circles, priority was given to the development of industry, power, transport and communications at the expense of agriculture, partly because the dimension and complexity of the agricultural problems were not fully realized during the first few years of independence and partly due to the overconfidence in the country's agricultural performance and also in view of the prevalent "normal" circumstances as pointed out by Ali (1967):

> "The rainfall was normal. The country was self-sufficient in food - by how narrow a margin few cared to ponder. The prices of the main cash crop, jute and cotton, were reasonable with a tendency to rise. The much-feared depression after the end of the Second World War had not occurred. The departure of Hindu money-lenders from West Pakistan had almost wiped off the debt burden and given immediate relief to the cultivators, and the shortage of rural credit was not to make itself felt until later." (24)

However, it soon transpired that the country's agricultural performance was deteriorating with a tendency to frustrate all hopes of self-sufficiency in foodstuffs, especially in view of the mounting population and demand for food. Early official inquiries such as the report of the Economic Appraisal Committee (1952) attributed this failure to the stoppage or reduction of canal water, frequent failure of rainfall, the diversion of area under food crop to cash crops and black marketing and smuggling of food. (25) The multitude of other factors at play included : the age old technology, lack of capital and knowledge

about modern agricultural technology, uneconomic land tenure system characterized by large feudal estates or small fragmented holdings, absence of chemical fertilizer use, waterlogging, salinity and soil erosion; and above all, vagaries of nature such as floods, droughts, pests, diseases and locust visitations.

Crops in Pakistan are always exposed to the vagaries of weather, in particular the irregular monsoon rains, but the stoppage of canal water by India soon after Independence, made Pakistan's agriculture more vulnerable to natural factors. This, combined with the acute conservatism and absence of agricultural education amongst the farmers, depressed the country's agricultural performance. The quick profits in commerce and industry, on the other hand, detracted capital from agriculture. Similarly the assumption in the government's price policy that crop production would not be affected by a reduction in prices resulting from high export taxes and compulsory government procurement gave rise to smuggling, black marketing and a disincentive to produce wheat, especially in the major wheat producing areas. (26) The net result of all this was that, whereas during the period 1950-1/1955-6, the country's value added in manufacturing jumped by 65.7 per cent, that in agriculture rose by a mere 4.8 per cent while in the major crops it remained unchanged. In 1952, drought caused a wheat shortage and large quantities had to be imported. Thus, whereas in 1950-1 the country's exports constituted 53.5 per cent of the total foreign trade, in the succeeding year their share fell to 38.5 per cent.

The failure of agriculture, in particular the food deficiency and large expense on its import, caused a radical change in the government's outlook in the mid-1950's,and agriculture earned a high priority in economic planning. To reform agriculture meant its transformation from subsistence to commercial, embodying, inter alia, a change in the socioeconomic climate of rural life, sweeping reform in the land tenure system, large capital investment, diffusion of modern techniques and know-how, promotion of fertilizer and pesticide use, distribution of better seeds and provision of adequate credit facilities.

However, no real progress can be made unless the farmers shun their obscurantism and adopt the innovations introduced by the government.

The Land Reforms of 1959 fixed the ceiling of land ownership at 200 ha. of irrigated and 400 ha. of unirrigated land; established security of tenure for the farmers who had hitherto cultivated land without owning it; provided for credit facilities to the farmers and a sound programme for consolidation of scattered and fragmented holdings; abolished jagirs (feudal estates); and spelled out measures pertaining to the apportionment of produce between the tenant and the landlord. As a result, from 1959 to early 1968, the total area taken over by the government was 952,100 ha. of which 346,000 ha. or 36.4 per cent was distributed among the tenants and small land owners.(27) Total area affected by land consolidation was 988,632 ha. between 1947-8 and 1959-60, but rose to 5,387,906 ha. between 1960-1 and 1969-70 to which another 1,086,565 ha. had been added by 1974-5. (28)

Although land reforms ameliorated the socioeconomic climate of the countryside by regulating tenant-landlord relations, the major breakthrough in the country's agriculture was rooted, as suggested by Stern and Falcon (1970), in an "incentive-technology" strategy involving three assumptions : a) that the farmers of the region would respond to economic stimuli; b) that one of the most important actions that the government could take would be to create a favourable economic climate for the farmers; and c) that sound economic policy would be fruitless unless major efforts were made to supply modern agricultural inputs at the right place and time. (29)

According to these authors, in the implementation of this strategy a few policy decisions were important. These included the abolition in 1959 of the foodgrain zoning; lifting, in 1960, of controls on wheat movement and prices; and regularization of wheat supply in the market from government stock, a sizeable part of which came from the USA through its PL 480 programme. Another prong of this strategy focussed on input subsidies and input distribution. Thus,

major subsidies were provided for fertilizer and pesticides and a large volume of increased public sector irrigation water was priced at less than average cost.

In addition, top priority was given, after September 1960, to the Indus Basin programme for the speedy construction of replacement works. Earlier, in order to wipe out the most threatening "disease" - waterlogging and salinity - the Salinity Control and Reclamation Projects (SCARPs) had been initiated in the early 1950's. Thus, in order to lower the water table, hundreds of irrigation wells and tube wells had been dug by the government which also provided water for irrigation. (30) This not only contained the problem of waterlogging and salinity, but in fact paved the way for a rapid development of groundwater sources. As a result, thousands of tube wells were installed during the 1960's (Section 2.6)

Rural credit facilities were improved under the aegis of the Agricultural Development Bank of Pakistan, and loans advanced to the farmers jumped from Rs. 0.08 million in 1952-3 to 30.9 million in 1960-1 and 415.2 million in 1973-4. (31) Further, on the recommendation of the Food and Agriculture Commission 1959, the Agricultural Development Corporation was set up to advise farmers on agricultural operations and to arrange their necessary supplies such as seeds, fertilizer and pesticides.

Thus, after a poor performance during most of the 1950's, Pakistan's agriculture made a recovery in the early 1960's and attained a considerable momentum in the succeeding years. This upsurge has earned a good deal of academic attention and several studies attempted to identify the factors responsible for this. Perhaps the most influential and the pioneering was that of Mohammad (1964) in which he emphasized the role of two key inputs - water and fertilizer - in the improvement of the country's agriculture. (32) In a subsequent study, Mohammad (1965) showed how the increased water via the private tube well development had influenced the region's cropping patterns and intensity (Section 5.5.4) and thus brought home that, water being the major constraint, the upsurge in the region's agriculture was almost entirely explicable in terms

of the availability of additional water. (33)

Falcon and Gotsch (1968) extended Mohammad's investigation by including other inputs. Considering the change of Pakistan's agriculture during the Second Plan period (1959-60/1964-5), when the value added in total agriculture and the major crops increased by 3.8 and 4.9 per cent per year respectively, these authors attempted to explain the growth factors. According to them, 40.8 and 14.3 per cent of the growth in the output of major crops was due to the increase of water supply through tube wells and canals respectively; 28.6 per cent due to the increase of fertilizer and plant protection; 4.1 per cent due to better seeds and 12.2 per cent because of improved techniques and other factors. (34)

Since the data used in the above study pertained to the period before the "Green Revolution", these results do not, in fact, explain the real impact of the improved seeds. However, the high yielding seeds played an important role along with fertilizer and increased water in bringing about the "Green Revolution". (35) In a study on the effects of mechanization, it was concluded that, while the tractor had no influence on cropping intensity in the saline groundwater areas where tube well water was not available, in the tube well areas it made a considerable impact on cropping intensity. (36) Thus, the advantages of mechanization could be reaped only if the prerequisite of abundant water supply was fulfilled.

In another study, Burki (1974) focussed attention on the non-economic determinants and thus attempted to trace the role played by the Land Reforms of 1959, the system of Basic Democracies and the centralized planning in the Punjab's agricultural growth. Dividing the Province, on the basis of agricultural performance, into two regions viz. a) with high rate of growth, consisting of the seven agriculturally richest districts : Multan, Sahiwal, Gujranwala, Sialkot, Lyallpur, Sheikhupura and Lahore; and b) the other twelve districts where agricultural growth was insignificant; Burki asserted that the success of the agricultural sector in the first region was mainly due to the creation of a local government system which served as a conduit for the redistribution of some of

TABLE 5.13

CORRELATION MATRIX FOR TWELVE AGRICULTURAL VARIABLES

1. % change in net sown area	+1.000 *+1.000*											
2. change in cropping intensity	+0.151 *-0.017*	+1.000 *+1.000*										
3. % change in wheat area	+0.555 *+0.453*	+0.645 *+0.527*	+1.000 *+1.000*									
4. % change in wheat production	+0.703 *+0.701*	+0.515 *+0.280*	+0.881 *+0.822*	+1.000 *+1.000*								
5. % change in wheat yield	+0.658 *+0.677*	+0.412 *+0.049*	+0.683 *+0.439*	+0.941 *+0.869*	+1.000 *+1.000*							
6. % change in cotton area	+0.682 *+0.663*	+0.201 *+0.089*	+0.180 *+0.025*	+0.369 *+0.261*	+0.444 *+0.401*	+1.000 *+1.000*						
7. % change in cotton production	+0.622 *+0.610*	+0.243 *+0.162*	+0.161 *+0.046*	+0.303 *+0.219*	+0.353 *+0.314*	+0.963 *+0.964*	+1.000 *+1.000*					
8. % change in cotton yield	+0.203 *+0.134*	+0.074 *-0.048*	+0.001 *-0.174*	+0.063 *-0.170*	+0.109 *-0.149*	+0.388 *+0.348*	+0.533 *+0.507*	1.000 *+1.000*				
9. % change in total irrigated area	+0.326 *+0.368*	-0.013 *+0.029*	+0.008 *+0.081*	+0.132 *+0.307*	+0.162 *+0.417*	+0.203 *+0.262*	+0.105 *+0.134*	-0.029 *-0.009*	+1.000 *+1.000*			
10. Level of fertilizer use	+0.076 *-0.082*	+0.447 *+0.219*	+0.458 *+0.161*	+0.467 *+0.030*	+0.463 *-0.079*	-0.131 *-0.391*	-0.116 *-0.323*	+0.100 *-0.061*	-0.417 *-0.491*	+1.000 *+1.000*		
11. Level of Mechanization	-0.134 *-0.081*	+0.421 *+0.359*	+0.446 *+0.371*	+0.359 *+0.249*	+0.265 *+0.084*	-0.419 *-0.549*	-0.387 *-0.481*	-0.094 *-0.171*	-0.223 *-0.162*	+0.704 *+0.723*	+1.000 *+1.000*	
12. Level of Tube well water use	+0.211 *+0.119*	+0.403 *+0.164*	+0.550 *+0.325*	+0.595 *+0.297*	+0.562 *+0.178*	-0.165 *-0.416*	-0.140 *-0.342*	+0.225 *+0.107*	-0.108 *-0.080*	+0.801 *+0.687*	+0.698 *+0.714*	+1.000 *+1.000*
VARIABLES	1	2	3	4	5	6	7	8	9	10	11	12

Figures in italics are for the 16 districts of the Punjab Plain

SOURCE: computed by the author

the political, economic and social power that had hitherto been enjoyed by the Province's big landlords. The highly improved agricultural performance of these seven districts was possible since the class of farmers that could have performed important entrepreneurial functions was cultivated by the regime as its principal rural constituency which enjoyed a good rapport with various government agencies.(37)

It is argued that agricultural productivity is influenced by the farm size. Khan (1979) investigated this aspect of agricultural change in Pakistan with reference to the use of the "non-traditional" inputs associated with the "Green Revolution", and concluded that, firstly, large farms (over 10 ha) are more efficient than small farms by having greater output per ha; secondly, the per ha. use of the "non-traditional" inputs such as fertilizer, hired labour and farm machinery is greater on large farms; and thirdly, large farms benefit more from the government's credit schemes.(38) However, based on cross-sectional data, these findings can not be generalized. Our analysis of the average farm size of the districts and various other inputs and outputs gave no significant result - the highest value of correlation found was between the average farm size and: the change in groundwater irrigation (+0.509) and the change in the yield of wheat (+0.402).

An analysis for the agricultural change in the Punjab's 19 districts during the period 1958-9/1962-3 to 1970-1/1974-5 was conducted. Some of the results are presented in Table 5.13. Obviously, water is the most effective and overriding input of the Province's agriculture. This is reflected in a strong correlation between the total irrigated area and : net sown area (r = +0.854), total cropped area (+0.912), wheat area (+0.818), cotton area (+0.847), wheat production (+0.943), cotton production (+0.821), wheat yield (+0.913) and cotton yield (+0.836).

The other most important input is the agricultural labour force - a fact brought home by a strong correlation between the district agricultural labour force and : net sown area (r = +0.821), total cropped area (+0.846), wheat area (+0.858), cotton area (+0.787), wheat production (+0.925), cotton production (+0.776), wheat yield (+0.738) and cotton yield (+0.639).

As regards the agricultural change represented by our selected variables, some eye-catching results emerge from our analysis. 1) The increase in wheat and cotton production was basically caused by the increase in their respective areas. As we know, due to the enhanced water supply in the 1960's, the Province experienced an appreciable change in its cropping patterns and intensity. Thus the areas under wheat and cotton rose at a much higher rate than did the net sown or total cropped areas. This indicates that a large part of the old sown as well as of the newly added areas was utilized for wheat and cotton cultivation. Now, although in the case of wheat, better seeds played a significant role in the increase of its total and per ha. output; in cotton, the increase in its area played a greater part in increasing its production. Between 1958-9/1962-3 and 1970-1/1974-5, the area, production and yield of wheat in the Punjab as a whole rose by 20.9, 83.5 and 51.7 per cent respectively,but the corresponding increases in cotton were 60.6, 111.9 and 34.8 per cent. This disparity is clearly reflected in the coefficients of correlation between the respective increases in areas and productions of the two crops - +0.881 for wheat and +o.963 for cotton. 2) There is a strikingly high correlation between the modern inputs, indicating that the use of chemical fertilizers and tractors is common only where the limitation of water has been removed with the development of ground water irrigation - the facts already underscored. 3) Although various agricultural variables manifest strong correlation with water, agricultural labour force and some other inputs, this analysis has not succeeded in finding out any force with which the agricultural change variables bore a strong association. The only notable correlation exists between the rural dependency ratio - an index of population pressure in the countryside - and : change in the total cropped area (r = +0.700), change in wheat production (+0.715) and the change in wheat yield (+0.712).

5.8. SUMMARY AND CONCLUSION

This chapter has examined the agricultural change in the region particularly since the inception of Pakistan. It opened with a resumé of Pakistan's economic

endowment at its independence and looked at its progress during the succeeding decades. After having obtained a clear view of agriculture's importance in the national economy, attention was focussed on its change during the post-Independence decades. First, the distributional patterns of the agricultural areas and the cropping intensity and patterns were carefully examined and then, the level and trends of agricultural change were taken into account.

In order to have a closer look at the regional variations of agricultural change in the Punjab, net sown area, cropping intensity and wheat and cotton crops were selected. In the last section, an attempt has been made to explain the region's agricultural development in terms of a multitude of physical, economic, social and political influences.

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CHAPTER VI

INTERRELATIONSHIPS BETWEEN POPULATION GROWTH AND AGRICULTURAL CHANGE

6.1. INTRODUCTION

As indicated in Section 1.3, a major objective of this study is to explore the nature and degree of association between the Punjab's population change and its economic development with particular emphasis on the agricultural sector. In order to set the stage for comparison between the two families of variables, an attempt has been made, in the three preceding chapters, to understand the patterns of population growth and distribution and those of agricultural change.

The analyses of population growth and agricultural change in those chapters provide sufficient ground for discussion in the present chapter which focusses on comparisons between the two sets of variables. The objective is, in particular, to ascertain by bringing together the foregoing material whether or not there exists any definite and systematic agro-population pattern in the Punjab. There are two main objectives of the present chapter; first, it makes an attempt to define the theoretical grounds by summarizing some of the related concepts; and second, it examines through a statistical method the degree and pattern of association between the population and agricultural variables.

6.2. POPULATION GROWTH AND ECONOMIC DEVELOPMENT : THEORY AND CONCEPT

The question of the relationship between population growth and economic well-being is by no means new. To philosophers, statesmen, economists and population scientists alike, it has been a subject of debate for centuries, producing divergent views. In the remote past, Confucius and Plato, for instance, expressed concern in their respective times and areas, about the size of population, its desirable growth rate and the ways of influencing its evolution. (1)

The earliest concerns about population were obviously motivated by the effects of population size on the society's well-being. Thus, whenever signs

emerged of some "imbalance" between population and the exploited resources, attention was largely focussed on the "enormity" of the population size rather than on the inadequacy of the resource development. However, these early writings were more in the nature of speculation and vague thought rather than systematic observation and analysis. Malthus (1766-1834) was one of the first to consider the relationship between population and the level of well-being in a scientific perspective. Identifying a disparity between the potential growth of population and the means of subsistence, Malthus asserted that, whereas population numbers tended to increase geometrically, the means of subsistence could increase only arithmetically. He then argued that the disparity between the two rates of growth acted like a natural "brake" on population, since the increase of population was necessarily controlled and regulated by the means of subsistence.(2)

It is obvious that Malthus' theory dealt basically with the interrelation of population and production on the assumption that food supply suffers from inelasticity and, in turn, determines the size and increase of population. Thus population growth, according to this theory, is a dependent variable determined by changes in total food production or by the factors influencing food output. Thus in any society there is, at any time, a warranted level of population increase to which the actual population growth tends to conform; any increase beyond that level would result in the operation of "positive checks" or "vice and misery". The rise in income, on the other hand, would increase population by increasing fertility and depressing mortality.

In response to the argument that an indefinite increase of population would increase the agricultural labour force which would result in better agricultural returns, Malthus suggested the law of diminishing returns in agriculture and argued that fertile land was limited and not capable of sustained and sufficient improvement. (3) However, his views in this regard were more scientifically presented by his contemporary, Ricardo (1772-1823) and his disciples, in the Law of Diminishing Returns.

Malthus' pioneering role in the formulation of a scientific theory of population notwithstanding, the publication of his Essay evoked a great deal of reaction for and against. As a result, the passing decades have witnessed a tendency in academic circles either to recast and reassert or to rebut and reject his views. In one such study, Leibenstein (1957) attempted to examine Malthus' model with a new methodology and by replacing the total product by per capita income. But, although his approach was much more quantitative, he too considered population as a dependent variable. (4)

In another study, Coale and Hoover (1958) investigated the effects of population growth on economic development. Whereas Malthus' schema considered only labour as a determinant of production from a given supply of land, Coale and Hoover chose the quality and quantity of capital as the major controlling factors in the development potential and thus defined a channel through which population growth would influence, via an increased labour supply, the total and per capita output. (5)

In summing up the effects of population growth on total output through the increased labour supply, these authors state:

> "The larger projected population has almost no advantage over the smaller in terms of potential working force until near the end of the thirty-year period we have analyzed, and even then the difference is small. The slightly greater number of persons of working age by 1986 under higher fertility would not necessarily provide a large useful working force, for two reasons. First the difficulties of finding useful employment for a rapidly growing labor force imply that a faster growth rate might simply add to the already large pool of unemployed and underemployed. Such an outcome is made more probable by the slower accumulation of capital when fertility is high. Second, the necessity for devoting much more time to child care would limit the participation of women in the labor force." (6)

The authors further asserted that total output would grow faster with reduced fertility and thus, in essence, arrived at almost the same conclusion as Malthus, though by an entirely different approach.

In another study, Ohlin (1966) presented a similar "classical" view about the relationship between population growth and economic development in the past,

considering the former a dependent variable.

> "By and large the growth of population in the past must to a large extent have been a response to economic advance in a broad sense. Instances of "population pressure" undoubtedly occurred, but the broad sweep of growth is more easily interpreted as a consequence of the opening up of new territories and industries". (7)

As is evident from the above discussion, the commonly held classical view was that in primitive societies some sort of environmental determinism operated whereby a complete lack of powerful modern aids coupled with limited resources resulted in privation and hunger and thus acted as a natural "brake" on population growth. Not only that, the economists with the classical bent further assert that population growth generally has an adverse effect on economic development; and in the case of agriculture, excessive population growth inevitably creates over-population and underemployment, subdivision and fragmentation of holdings, lack of capital and indebtedness, and a decline in the real income - all of which are bound to result in a retarded agricultural performance.

Contrary to this is the argument that not only does population act as a catalyst in economic improvement but also that, without such a stimulus, human society is likely to remain economically and culturally stagnant. Such anti-Malthusian views can be traced back to the fourteenth century writings of Ibn Khaldun, the Arab philosopher-historian, who asserts in his Prolegomena that the growth of population is ultimately checked, not by scarcity of food, but by the decadence of civilization; (8) and also to the eighteenth and nineteenth century works of Sir James Steuart, John Weyland, Herbert Spencer and others. (9) However, pioneer works in this area during the recent past are those of Clark (1967) and Boserup (1965), who have presented historical evidence to the effect that the problem of overpopulation has been largely exaggerated and is not so wide spread as implied.

According to Clark, population growth provides a stimulus to economic development; in agriculture it usually leads to changes both in methods of cultivation and in social and economic relationships, which are capable of

greatly raising the return per unit of labour input.

> "Population growth has taken place, and will continue, because of improvements in medical knowledge and practice. It brings economic hardship to communities living by traditional methods of agriculture; but it is the only force powerful enough to make such communities change their methods, and in the long run transforms them into much more advanced and productive societies." (10)

Several other authors have also emphasized the stimulative role of population growth in economic development and particularly in intensification of agriculture;[11] but the theory of agricultural growth which has won the greatest academic attention since the late 1960's is that of Boserup. [12]

Looking at the problem of agricultural change along the historical time scale in an entirely new perspective, and discarding the dichotomy of cultivated and uncultivated, Boserup (1965) attacks the Malthusian concept of the inelasticity of food output. Considering the substitution of sedentary cultivation by shifting cultivation and a reduction in the length of fallow period under mounting population pressure in the primitive communities of Asia, Africa and Latin America, she suggests a reversal of the Malthusian concept by regarding population as an autonomous variable. Boserup thus considers growing population pressure to be a stimulus for technological change in agriculture, which not only paves the way for a steady intensification of agriculture but also spurs the whole range of socioeconomic forces and results in changes in the land use pattern, agricultural technology, land tenure systems, cropping patterns, labour input-output relationship and settlement form.

> "----it is unrealistic to regard agricultural cultivation systems as adaptations to different natural conditions---- cultivation systems can be more plausibly explained as the result of differences in population density : As long as the population of a given area is very sparse, food can be produced with little input of labour per unit of output and with virtually no capital investment----As the density of population in the area increases----it becomes necessary to introduce other systems which require a much larger agricultural labour force." (13)

Asserting that primitive communities with sustained population growth have a better chance to enter a process of genuine economic development than

primitive communities with stagnant or declining population, Boserup further argues that:

> "---- agricultural change in primitive communities (is) an adaptation to gradually increasing population densities, brought about by changes in the rates of natural population growth or by immigration---- population increase leads to the adoption of more intensive systems of agriculture----and an increase of total agricultural output.---- On the one hand, the intensification of agriculture may compel cultivators and agricultural labourers to work harder and more regularly.---On the other hand, the increasing population density facilitates the division of labour and the spread of communications and education." (14)

Concerning the impact of rural-urban migration on agricultural performance, the author argues that:

> "In cases where the migrations from village to town---are allowed to continue without restraint, the ensuing relative rise of food prices may provide the needed incentive for an intensification of agriculture and be followed by a rise of rural money wages which helps to keep migration within bounds." (15)

In a nutshell, Boserup's thesis is that, in pre-industrial societies, agrarian changes are caused by increasing population. Agriculture is seen not as mere crop and livestock production but as a dynamic land-using system. Viewed in a broad perspective of time and space, the essential yardstick of agricultural change is its intensification which is not - as Ricardo and other classical economists believed - a greater application of capital and labour per unit of cropland, but a greater intensity of land use i.e. diminished duration of fallow. In this model, the degree of intensification is viewed as a dynamic continuum passing through five stages - long forest fallow (20-25 years), bush fallow (6-10 years), short fallow (1-2 years), annual cropping and multicropping - but not all agriculture necessarily passes through all stages. (16) Increasing population density is viewed as a spur to the intensification of land use which, in turn, is likely to cause change in agricultural implements (axe and digging stick to hoe to plough), fertilization techniques (ash to vegetation to manure) and tenure system (no permanent occupation of land to permanent ownership). Intensification is characterized by, inter alia, an increase of labour per unit of land, and longer and more regular hours. As a result, although there is

initially a decrease in output per man-hour at each stage, the total output is nonetheless higher than at the preceding stage. Thus, pre-industrial societies enter the next stage of intensification only when they are impelled by land scarcity resulting from mounting population density. The essential outcome of this is that "---population growth often seems to be the cause of prosperity, in sharp contrast to the causation from prosperity to population growth and poverty, which was suggested by Malthus." (17)

Since it was novel and important, Boserup's theory had a stimulating effect in the academic circles, arousing varied responses. However, in the first few years after publication, some writers were rather more critical in their comments on the theory. Jones (1967),among others,pointed out a few deficiencies and questioned the "mass of assertions" in the theory; (18) while Diebold (1967) underscored the non-quantitative approach in the explanations; (19) and Olmstead (1970) described it as the substitution of geographical-environmental determinism and cultural-historical determinism by a "population density determinism". (20) However, some of Boserup's ideas seem to be gaining acceptance particularly in recent years. Clark (1967) was one of the first and most ardent supporters of Boserup's theory. (21)

The bedrock of Boserup's model is a positive relationship between population pressure and agricultural intensity. Population pressure, once generated, will not only cause agricultural intensification but will also bring about technical changes since subsistence farmers are labour-efficient and will select the intensity of cultivation and agricultural techniques which will fulfil their agricultural requirements with the minimum amount of work. Thus, not only will an increase in population pressure cause an increase in agricultural intensity but also the latter will be interdependent with the new farming implements. Various studies based on field observations of subsistence agriculture have supported this model or suggested some modifications.

Before considering the modifications of Boserup's scheme, let us examine a similar but earlier work. Brookfield (1962) made a significant contribution in

this field by investigating the distribution of distinctive agricultural methods and local variations in terms of 26 primary or derived characteristics in 31 localities in Central New Guinea, and discovered the widest range of technical elaboration in the four areas of highest population and occupation density where the greatest variety of terrain was also utilized. He then postulated that the elaborate techniques of ground preparation and water control in use in some localities had probably evolved from an initially simpler and less intensive method of agriculture. (22) But, although it was a systematic inquiry, Brookfield did not present its results in a theoretical framework and did not treat it as broadly as Boserup.

Clarke (1966) was one of the first to conduct a field study within the perspective of both Brookfield and Boserup's ideas. Taking into account four communities in New Guinea whose varying agricultural methods could be interpreted as stages along a hypothetical chain of development, Clarke supported Boserup's model by concluding that, in response to population pressure and the consequent deterioration in the environment, a simple shifting cultivation can develop into a more elaborate and intensive agriculture. (23) Further support in this regard came from Netting (1969) who concluded that "population pressure appears to be the critical variable, the engine which sets in motion adaptive changes in a set of related technological and social variables among subsistence cultivators". (24) A study by Vermeer (1970) focussed on the population pressure and crop rotational changes in a tribal community of Nigeria and found that a new cropping pattern had evolved in the areas of high population density where population pressure had degraded the environment and exceeded the carrying capacity of the land. Not only that, marked changes in cultural patterns and practices accompanied those in the cropping patterns so that the societal system appeared to "be veering from established cultural customs." (25)

Smith (1972) attempted an archaeological explanation of the changes in population pressure and not only pointed out an interdependence between population, subsistence and social organization of a society but asserted that a shift in

population pressure causes a corresponding change in agricultural intensification and technology and in settlement patterns. (26) In a study by Waddell (1972), an attempt was made to formulate an intensification sequence in the present spatial periphery-to-core agricultural patterns in the New Guinea Highlands and it was pointed out that intensification occurs in response to a progressive increase in population pressure on resources, operating in marginal environmental conditions. (27) In an attempt to investigate the interrelationship between cultivation intensity, settlement patterns and homestead farms among the Matengo of Tanzania, Basehart (1973) affirmed that population pressure was the crucial variable in agricultural intensification. (28)

Brown and Podolefsky's (1976) study focussed basically on the effects of population density and agricultural intensity on land tenure and group size in the New Guinea Highlands, but it also provided immense evidence of a strong relationship between population density and agricultural intensity. Modifying population density by converting the interval measures of density to rank orders and choosing six agricultural skills as representative of agricultural intensity, these authors demonstrated a high positive correlation (r_s = .845) between the two variables. However, they were not sure about the causal direction of the relationship; and concluded that "the relationship between population density and agricultural intensity is interactional and that neither can be consistently antecedent to the other." (29) In another inquiry, Turner et al (1977) looked into the variation of agricultural intensity under population pressure among 29 groups of tropical subsistence agriculturists in Latin America, Africa and certain Pacific islands. Taking the ratio of the population of each group to the principal area of cultivation as a surrogate measure for population density, and the proportion of time each crop-fallow cycle is in the cropping phase as the index of agricultural intensity, this inquiry found that the two variables maintain a very strong relationship. In addition, such factors as staple crop, livestock and water resources and soil types were considered and it was discovered that subsistence base and environmental factors by themselves accounted for only

49 per cent of the variation in the logarithm of agricultural intensity, and that environmental factors had a stronger association with agricultural intensity than did the subsistence base factors. In the same study it was also discovered that the impact of population density on agricultural intensity diminished for those groups which inhabited areas with long dry seasons. (30)

As is obvious, all the above mentioned studies support the conclusion that there is a high positive correlation between population density and agricultural intensity; and most support Boserup's theory that population change is the cause of intensification of agriculture with its associated changes in labour employment and technology. In their view it is the mounting population density which compels the introduction of more labour-intensive and more productive form of agriculture. Contrary to such findings were those of Datoo (1976) who conducted his empirical study in one of the high density areas of Tanzania and not only found Boserup's measure of agricultural intensity unsatisfactory but also concluded that farm intensities do not necessarily correspond to population densities. However, the author goes on to identify a principal cause for the agricultural system to be incongruent with population density - the lack of sufficient stress within the agricultural system to justify investment in efforts at the intensification of agriculture. (31) In a subsequent study, the same author attempted to reformulate Boserup's schema in systems terms and pointed out some of its major imperfections, questioning particularly Boserup's "unicausal" conceptualization of agricultural change, and underscoring its inadequacy in considering any set of constraints within which agricultural systems evolve and its failure as a theory in explaining all situations of population density - agricultural intensity relationship. (32) Another study (Bhatia 1968) also criticized the "unicausal" approach of Boserup's theory and its failure to recognize other factors leading to change in agricultural systems. (33) Indeed, in a later work Boserup has stated that "existing agricultural systems in developing countries are adaptations to historical differences in the degree of population pressure", (34) thereby reiterating her earlier view that land use intensity reflects only variations of

population density. This means that other factors, particularly the natural factors, do not bear any significance in agricultural systems. However, the fact is that climate and soil types play a vital role in agricultural performance in many parts of the world. And, as we have examined in Sections 5.5 and 5.7, in the Punjab's agricultural change availability of water has been of crucial importance. Indeed the increased water supply through ground water exploitation during the 1960's paved the way for a rapid intensification of cropping in the Province.

Perhaps the sharpest criticism of Boserup's theory was directed at its assertion that increased labour input will not result in a commensurate increase in productivity or output per man-hour, meaning that increased labour will produce diminishing returns. Prima facie this is identical to Malthus' model. (35) However the Law of Diminishing Returns is supposed to operate only in situations where labour inputs are increased without corresponding increases in capital, technology and social organization; (36) and Boserup's major focus is on the 'traditional' agriculture of pre-industrial societies where the use of industrial inputs is not quite possible or undertaken. A verification of this assumption in the field is difficult since according to a strict application of the terminology - "pre-industrial" and "traditional" - very few societies in today's world provide any evidence to that effect; and as we see, even in most Third World countries, where agriculture is in a state of development, growth of labour force coupled with the use of modern technology has given increasing returns to labour. (37) According to Beguin (1974), the output per man-hour in three African regions was higher in the long fallow system than in annual cropping if only traditional methods were employed, but annual cropping yielded a higher output per man-hour when modern inputs were used. (38) Eder (1977) drew similar conclusions in his study of the Philippines. (39) Due to semantic differences and also to varying methods of data collection for labour inputs and outputs, comparisons are difficult to make. This problem becomes more acute in a large area like the Punjab which is characterized by marked regional variation not only in population density but also in agricultural

intensity. The fact is that agricultural intensity exhibits a great deal of variation within the Punjab, often from village to village, even from farm to farm - sometimes the same farm employs extensive and intensive methods side by side. Accordingly, the volume of inputs also demonstrates substantial variation and the district level data involve a great deal of generalization. However, as is clear from Table 6.3, the growth of the agricultural labour force (ALF) together with modern inputs have resulted in an increased production per capita ALF in some districts.

The third major criticism of Boserup's theory stems from the implicit assumption that, under mounting population pressure, extension of cultivation into unsettled areas is unlikely. This is difficult to accept since our area of study presents much evidence to the contrary where considerable expansion of the cultivated area has taken place during the last one hundred years. Boserup too accepted such a possibility in a later work where she noted that "The first, spontaneous reaction of tribal or peasant families to population growth within their community is to look for additional land to cultivate by the traditional methods. If no such land is available they have to use the land at their disposal more intensively." (40)

Although the acid test of a theory is its wide application and ability to explain all cases it confronts, many theories fall short of this and do not, therefore, possess the quality of universal applicability. There seems to be a general accord, for instance, in academic circles, that Malthus' doctrine can not be applied to the world as a whole; nor can the neo-Malthusian concept be universally true that technological developments in agriculture, though culminating in large increases in food output, inevitably result in overcropping and an ultimate degradation of land resources. By the same token, it should be inappropriate to judge the merit of Boserup's theory from the standpoint of its universal applicability. The fact is that, in the great majority of cases, it is rapid population growth which compels agricultural communities to initiate agricultural change, particularly in methods and land use. Rapid population growth creates a

challenge for the community as a whole and, in Boserup's view, this is a pre-condition for change since without this compulsion societies are not prompted to change. (41) Whether such a challenge is a prerequisite for some positive response is questioned by De Vries (1972): "Conceivably, a society can adopt customs which prevent population growth: there will be no challenge, and hence, no response. Alternatively, there might be the challenge, but no response. But what Boserup rules out is the response without the challenge." (42)

A significant contribution to the theory of population growth - agricultural change was made by Geertz (1963) who underlined a polar contrast between fragile swidden (cut and burn) and flexible wet-rice ecosystems and concluded that labour intensification in the former leads to a sharp decline of marginal returns and deterioration of environment; in the wet-rice ecosystem, however, it is rewarding since labour intensification together with inputs of skill create an extraordinary elasticity of response which facilitates the process of "agricultural involution". The wet-rice ecosystem is capital-labour-skill intensive and involution is characterized by the intensification of organization to an extreme degree.(43)

It can be summed up from the foregoing examination of various theoretical schemes that, although there have been a number of models of the interrelationships between population and agricultural changes, these have nonetheless provided no complete and satisfactory explanation. Wide regional variations in population growth and agricultural systems have further complicated their interrelationship. As a result, the two are so intricately interwoven that it is often exceedingly difficult to identify the nature of the mechanism involved. Thus it seems at first sight that the theoretical schemes are mere attempts to "arrange a marriage" between two entirely different phenomena or families of variables. However, looking at them closely, some interesting and provocative conceptual frameworks do emerge, though with limited applicability. The Clark-Boserup model, for instance, provides useful insight into the mechanism of "population pressure-agricultural change-economic development." That population growth stimulates labour-intensive agricultural innovations which in turn enable a country to

support its growing population on a given amount of land is sufficiently examplified by the population-agricultural experiences of many regions and countries of the world including Japan and Taiwan as well as the Punjab. It is believed that population pressure was a major reason why the government as well as individual farmers in Japan were highly motivated to develop, disseminate and accept new methods of cultivation. (44) Canal irrigation technology introduced in the Punjab after 1880 and, more recently, agricultural developments facilitated by modern scientific inputs - improved seeds, chemical fertilizers, tube wells, pesticides and mechanized implements - were also caused by the spur of population pressure. However, a crucial limitation to the dynamic motivating force of population pressure is that it seems to operate only if the rise of population pressure is slow so that societies get sufficient time to adapt proportionate changes in agricultural methods and land use.

That population density and agricultural intensity are closely associated, is an established fact. But, although various empirical studies conducted within Boserup's framework have concluded that there is a strong relationship between the two, the relationship is, in fact, exceedingly complex. As Brown and Podolefsky (1976) have very aptly remarked:

> "Population growth stimulates expansion, migration and intensifying agricultural practices. These make more land available for agriculture and increase food production in the locality, which will support a larger population. This intricate interrelation of land, population and agricultural technology takes many forms, with an overall high positive correlation. Unfortunately, the direction of the causal arrow can not be determined by statistical facts." (45)

It is common knowledge that a given amount of land can support a given number of people under a given set of technical, economic, political, social and cultural conditions without any serious deterioration of the land itself. Once this sort of "balance" is upset in an area (i.e. the carrying capacity of the area is exceeded by the growing population), the inhabitants seem to have three possible courses of action - colonization of new lands i.e. expansion of agriculture, intensification and emigration. (46) Thus there can be many types

of responses to rising population pressure, and the nature and extent of the response will depend on the nature and intensity of the population pressure as well as numerous other factors. In the words of Easterlin (1967):

> "The nature of changes in behaviour, if any, clearly depends on many conditions----the education of those involved, the supply of information and institutional conditions, which may impede changes along some lines and favor it in other directions." (47)

Underscoring the role of social and political institutions during a change under population pressure, Kuznets (1967) remarks:

> "A higher rate of population increase, although an additional problem, would probably not be as great an obstacle as the failure to exploit the potential due to delays in social and political institutions. Given some favorable development within the latter, additional population could be accommodated, even if possibly at the cost of a smaller rise in per capita income than might otherwise occur. Given less favorable development, even if population growth slows down, misery will continue----even though it might be aggravated by population increase. Thus, one could hardly argue that in much of Sub-Saharan Africa, Latin America and even Asia, a reduction of population growth, to say a tenth of a percent from the current annual rate of 2 or more percent, would significantly alleviate the acute growth problems." (48)

Thus, in order that a society may bring about changes in its economy under the spur of population pressure, it is of paramount importance that there are corresponding changes in the political, social, cultural, organizational, psychological and technical fields. This can be achieved by individual motivation and behaviour and also by the change of attitude and policy of the society as a whole.

6.3. POPULATION-AGRICULTURE : INTERRELATIONSHIPS IN THE PUNJAB

6.3.1. General

It is clear from the foregoing discussion that population growth-development has simultaneously been an old and a new topic of debate in academic circles. But, although an enormous volume of research has been conducted to unravel the real nature of the subtle and complex relationship between the two sets of variables - which has resulted in a pile of controversial literature - perhaps

no real synthesis between the two has been reached so far. Thus, it has been urged, and rightfully too, that "the algebra of population-development constitutes a veritable complex of variables that must be disentangled in order to discern their logic and inner coherence, both on the quantitative and qualitative level." (49) We now turn our attention to the analysis of the interrelationships between these two families of variables in our area with particular reference to agricultural variables.

It is evident from Chapters III and IV that the Punjab offers a striking example of a region where the changes in population and agriculture are closely associated. We know that, before the last quarter of the nineteenth century, a large part of British Punjab, despite its alluvial fertility, comprised a desert wasteland where population was sparse, the economy grossly underdeveloped and the level of urbanization very low. The Province's northeastern part, on the other hand, was densely populated; but although it was relatively more prosperous with a fairly productive rain-fed agriculture, its prosperity very largely depended on such physical factors as rainfall. Thus, with one of the highest densities of population on the one hand and an unreliable and uncertain economy on the other, the northeastern part was in the grip of population pressure. The overall pattern of population distribution, however, started changing when, beginning in the 1880's, the introduction of perennial canal irrigation not only laid down the basis of a new economy but also set in train a wave of population redistribution.

As pointed out in Section 4.4, a major objective of the canal irrigation development was to relieve the congested northeastern districts of their population pressure. It could, therefore, be argued that the basis of the region's new economy characterized by a flourishing agriculture was, in fact, laid down under the spur of population pressure. As a result, the western part of the Province, which now forms the area of the present study, broadened its food base through a spectacular increase in its cultivated area. Between 1868 and 1911, British Punjab's population rose by 23.9 per cent, whereas the Province increased its total cultivated area by almost twice as much - 40.3 per cent. During the

period 1868-1931, British Punjab's population rose by 49 per cent and its total cultivated area by 50 per cent (Table 2.6). In the areas constituting the Pakistani Punjab, where most of the irrigation development and the resulting agricultural expansion took place, total population rose by 34.5 per cent between 1901 and 1931 and the net sown area by 41 per cent (Table 3.7).

That population and agriculture are closely associated in the region, is further brought home by the results of an analysis showing the high positive correlation between the population distribution and the various categories of agricultural areas in the Province for the period 1931-72 (Table 4.5); and the same trend continued after Independence, despite a considerable transformation of the region's economy (Sections 3.2 and 3.6). A recent study by Sovani (1976) looked into the relationship between population and agricultural changes in the 12 districts of the present Indian Punjab for the period 1911-71 and found that, during the period 1911-41, there was a positive correlation between in-migration and agricultural output per unit area. The rates of change of total population and agricultural output were positively and "significantly" correlated during the decades between 1931 and 1961, whereas the natural rate of population change had no "significant" correlation with the agricultural output. (50) However, the author has not quoted the strength of the correlations. Keeping in view that the earliest and the great bulk of canal irrigation development and agricultural expansion took place in what is now Pakistani Punjab, the interaction between population and agricultural changes in this part is likely to be much more significant and for a larger time span. That internal migration was prompted by the dual force of population pressure and the opening of "new" areas is evident from the analyses in Chapters III and IV. The mounting population pressure in the old canal colony districts, and the opening of new agricultural lands with the completion of the Jinnah and Taunsa barrages after Independence, produced a repetition of what had happened before Independence on the much larger "canvas" of British Punjab as a whole. Thus a current of internal migration was set up between the Punjab's high pressure central districts and the newly opened lands

of Sargodha, Mianwali, Jhang, Muzaffargarh and Dera Ghazi Khan districts.

The close relationship between the region's population growth and agricultural change notwithstanding, it would be wrong to assume that the Province increased its population as a consequence of its broadened food base linked with its agricultural expansion. As discussed in Section 3.5, the region's population growth accelerated not primarily as a result of increased food supply, but because of reductions in mortality achieved mainly with the assistance of medical techniques introduced from the more developed world. Thus, after 1921 the death rates started falling rapidly, the fertility maintained its high level, and the resultant natural increase rates climbed sharply (Fig. 3.12).

6.3.2. Growth and Distribution of the Agricultural Labour Force

Let us now examine the agro-population changes in the Province after Independence. An obvious outcome of the rapid population growth is the sharp growth of the labour force - or in the rural sector, of the agricultural labour force. In a basically agricultural society, land and labour are the major agricultural inputs. Thus any discussion about agricultural change must inevitably focus on the performance of these two inputs and their relative behaviour and changes. The changes in the various categories of agricultural land in the Punjab were analyzed at length in Chapter V; and those in the agricultural labour force are dealt with here.

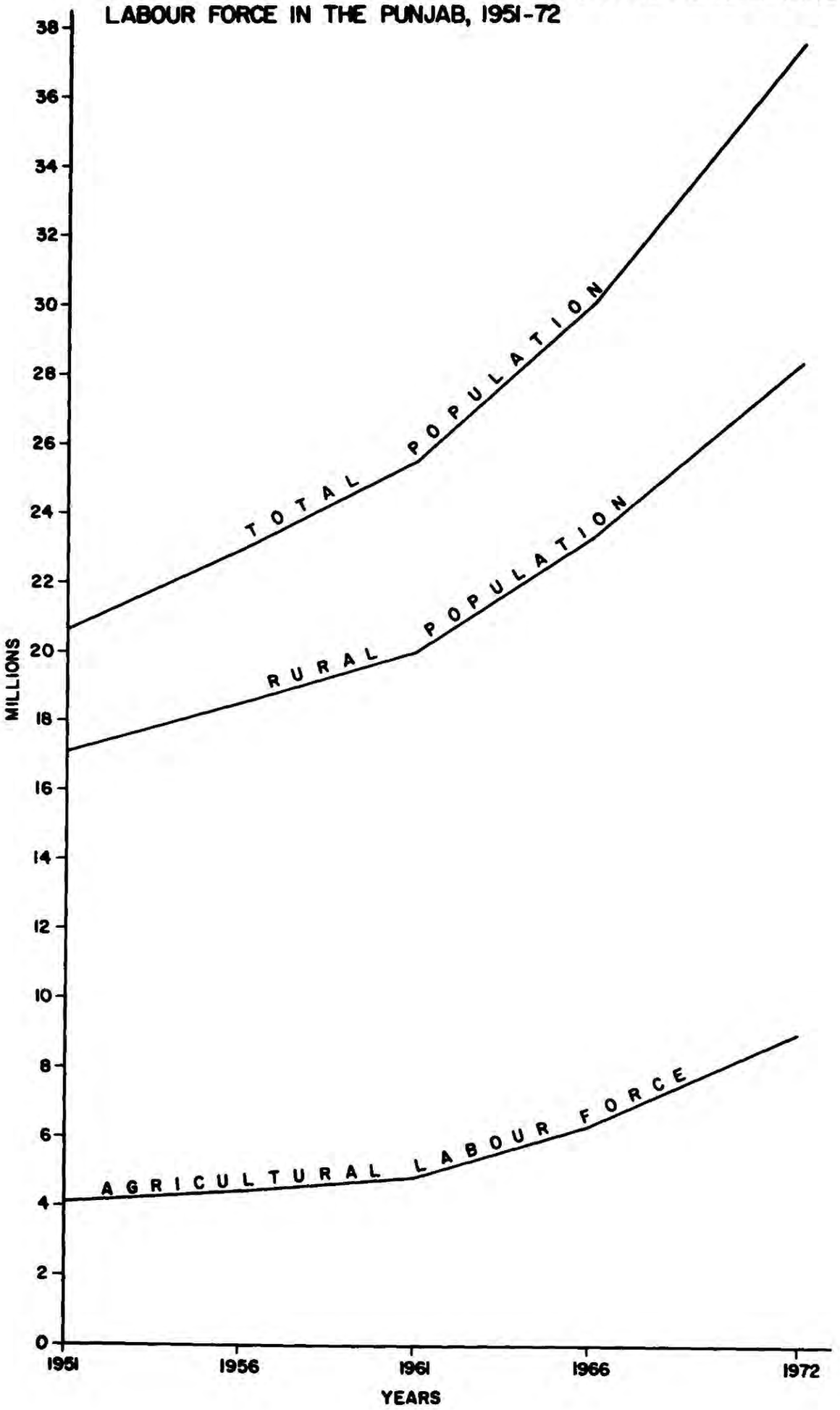
In the great majority of cases, economic development is accompanied by a decline in the proportion employed in agriculture. A rise in a country's GNP is usually associated with, inter alia, rural-urban migration. Nevertheless, the rural population continues to grow at the same rate, sometimes more rapidly, for quite some time, producing an increasing number of workers in agriculture. This has, in turn, a great bearing on the country's agricultural development, particularly in the regions of high population density and high intensity of land use where the chances of a horizontal growth of agriculture are limited. The rapidly increasing population, together with its redistribution, necessitates a

much larger increase in agricultural production than would be required without the phenomenon of urbanization and the related rural-urban migration; and much larger than the increase achieved by most of the present-day developed countries during the early stages of their development. How far and in what way a society responds to its population pressure depend on a multitude of factors. In Pakistan, particularly in the Punjab, horizontal growth of agriculture was one response to population pressure after the 1880's. This was supplemented by a vertical growth of agriculture after Independence, reflected in the rising intensity of cropping; and by mechanization and the use of high yielding seeds after the mid-1960's.

Between 1951 and 1961, the Punjab increased its agricultural labour force from 4,076,825 to 4,829,404 - by 18.4 per cent or at an average annual rate of 1.7 per cent. The corresponding increases in the Province's total and rural population were 23.4 and 17.4 per cent and the average annual rates 2.1 and 1.6 per cent respectively (Fig. 6.1). Part of the change in the Province's agricultural labour force was attributable to changes in the definition of labour force. The 1961 Census of Pakistan included persons 10 years and over in the labour force if the person was working for profit or earning wages or salary, helping any family member or was not working but looking for work. (51) Earlier, the 1951 census definition had been different in two respects. First, the minimum age limit for the labour force was 12 years; and second, a person had to be self-supporting or partially self-supporting to be included in the labour force. This had a considerable bearing on the enumeration of unpaid female family members and consequently on the comparability of the two enumerations. Further, in view of the region's low level of literacy, lack of sufficiently trained enumerators and a multitude of other factors, the reliability of census results has been open to doubt. This is particularly true in the case of the labour force statistics where the enumerators and respondents may not have bothered to report exact information since it required the answers to comparatively lengthy and involved questions. In addition, the identification of the "economically active population" is difficult, particularly in the agricultural sector which is characterized by

Fig 6·1

GROWTH OF TOTAL AND RURAL POPULATION AND AGRICULTURAL LABOUR FORCE IN THE PUNJAB, 1951-72



seasonal variations in the demand for labour according to the planting and harvesting periods. (52)

Part of the increase in the ALF during the period 1951-61 also came from the better coverage in the latter census. Held within less than four years of Independence, the 1951 census could not fully cover this aspect of the enumeration since not only were thousands of muhajirs immigrating to Pakistan every day but also the labour force was mobile in search of a better place to settle. In addition, once uprooted from their main callings, many muhajirs were not sure about the nature of their economic activity. The change in definition in 1961 made a significant contribution to the growth of the ALF by including the unpaid family workers who were largely excluded from the labour force in 1951.

Whatever the amount of error and spurious growth of the ALF, comparison between the 1951 and 1961 census results revealed an apparent growth of 18.4 per cent in the ALF of the Punjab as a whole. The highest rates of growth at the district level were experienced in Rahimyar Khan (81.3 per cent), Bahawalpur (45.4), Dera Ghazi Khan (42.7) and Muzaffargarh (36.8)(Table 6.1). Together these four districts experienced an increase of 51.5 per cent in their ALF which was associated with their improved agricultural performance and the resulting in-migration. Their rural populations increased by 47.2, 36.2, 22.2 and 31.6 per cent respectively compared with 17.4 per cent for the Punjab as a whole during that period. At the other end of the scale, Rawalpindi, Jhelum and Lahore experienced declines in their ALFs - by 10.6, 1.5 and 0.7 per cent respectively. This was partly due to rapid urbanization in these districts and the accompanying rural-urban migration but also, in Jhelum, to the construction of the Mangla Dam and the evacuation of the rural population and their resettlement in other parts of the Province.

The inconsistency of the ALF data is further exacerbated by the fact that the 1972 population census did not cover this aspect. Instead, the second agricultural census of Pakistan held in 1972 enumerated the agricultural labour force aged 10 and over. Thus a direct comparison of 1972 data with those of the

1951 and 1961 population censuses is not possible. In addition, the agricultural census was not a synchronous operation and could thus contain some degree of error due particularly to omissions and double counting. However, in order to have some idea about the growth of the ALF, the data given by the agricultural census are tabulated with those of the earlier periods given by the population censuses and these include both family workers aged 10 and above and hired labour (Table 6.1).

As Table 6.1 shows, the Punjab's ALF climbed by a spectacular proportion of 87.1 per cent between 1961 and 1972, at an average annual rate of 5.5 per cent. The corresponding increases in the Province's total and rural populations were 47.6 and 41.9 per cent. In eight districts - Rawalpindi, Muzaffargarh, Jhang, Mianwali, Multan, Bahawalnagar, Lyallpur and Sahiwal - the rate of growth of the ALF was higher than that of the Province as a whole.

6.3.3. Agricultural Labour Force and Production

In an analysis of agricultural change and particularly its interrelation with population change, a study of the association between agricultural labour force and agricultural production is of great importance. Figure 6.2 shows the distribution of the ALF in the Punjab's districts and their shares in the Province's total foodgrain production. It is interesting to note that the distributions of the ALF and of agricultural production, which is characterized here by foodgrain production, are almost identical. The highest share of the Province's ALF, for example, is contained by Multan (11.0 per cent) followed by Lyallpur (10.1) and Sahiwal (9.1); and these districts also produce the highest shares of the Province's food output - 11.9, 10.5 and 11.3 per cent respectively. The eight districts with the highest shares of the Province's ALF together contain 58.7 per cent of its agricultural labour force and produce 59.6 per cent of its food grains. The distortion of the otherwise smooth curve in the middle is caused mainly by Rawalpindi which, with 4.9 per cent of the Province's ALF, produces only 1.6 per cent of its food grains. An exactly opposite picture is presented by Gujranwala and Sheikhupura which, with 3.3 and 3.4 per cent of the Province's

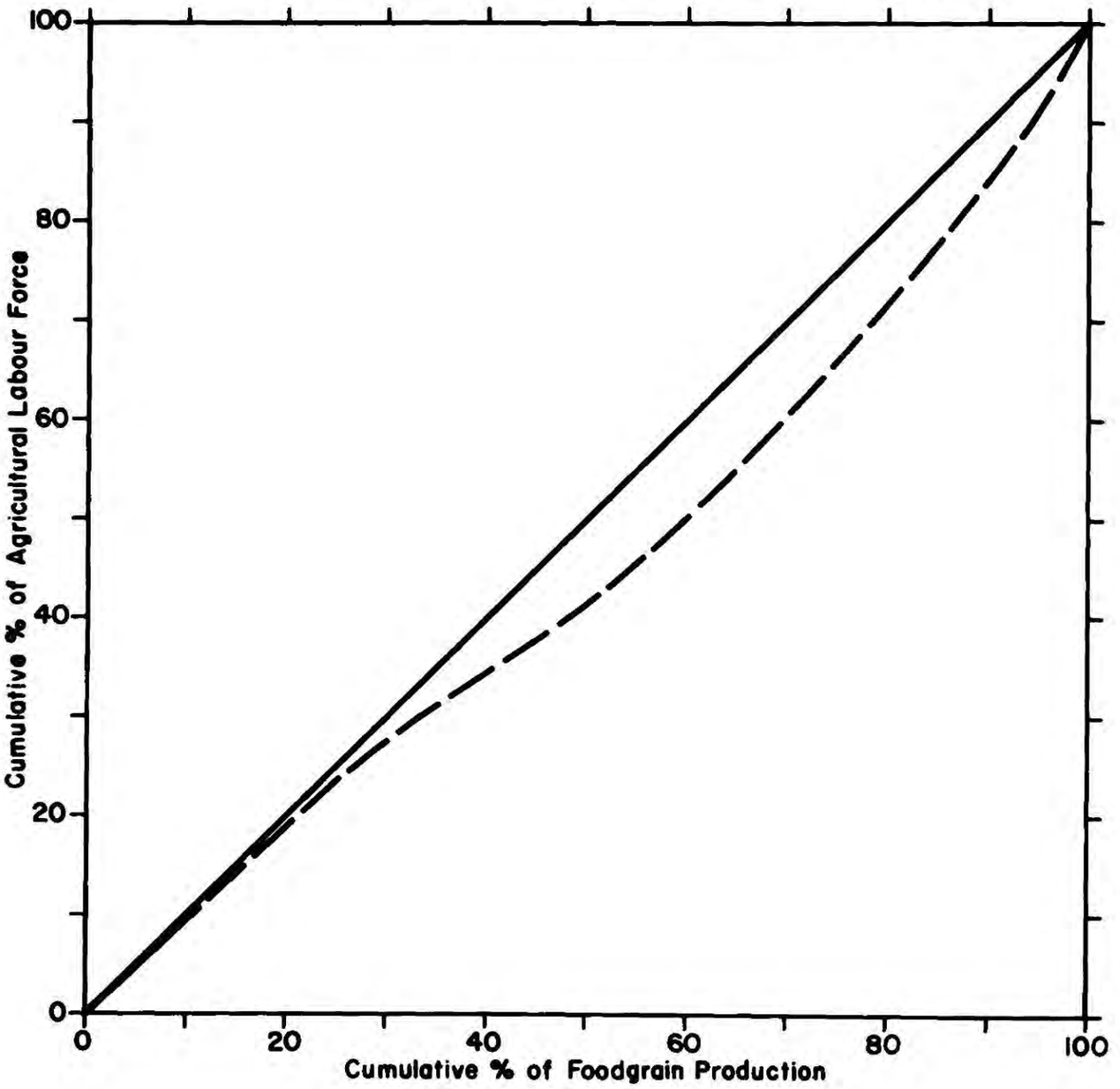
TABLE 6.1 GROWTH OF AGRICULTURAL LABOUR FORCE IN THE PUNJAB BY DISTRICTS, 1951-72

District	Agri. Lab. Force (000)			% change		
	1951	1961	1972	1951-61	1961-72	1951-72
1. RWP	179	160	439	-10.6	174.4	145.3
2. CPR	161	198	286	23.0	44.4	77.6
3. JLM	134	132	245	- 1.5	85.6	82.8
4. GJT	221	264	407	19.5	54.2	84.2
5. SRG	251	293	514	16.7	75.4	104.8
6. MWI	125	159	353	27.2	122.0	182.4
7. JNG	167	210	524	25.7	149.5	213.8
8. LYP	416	460	911	10.6	98.0	119.0
9. LHR	275	273	483	- 0.7	76.9	75.6
10. SLT	256	283	420	10.5	48.4	64.1
11. GWA	190	196	296	3.2	51.0	55.8
12. SHA	186	223	311	19.9	39.5	67.2
13. MTN	418	472	995	12.9	110.8	138.0
14. SWL	373	430	819	15.3	90.5	119.6
15. MZG	171	234	597	36.8	155.1	249.1
16. DGK	143	204	296	42.7	45.1	107.0
17. BWP	119	173	284	45.4	64.2	138.7
18. BWN	142	193	399	35.9	106.7	181.0
19. RYK	150	272	456	81.3	67.6	204.0
PUNJAB	4,077	4,829	9,035	18.4	87.1	121.6

SOURCES : computed from:

1. Census of Pakistan 1951
2. Census of Pakistan 1961
3. Agricultural Census of Pakistan 1972

Fig. 6.2
DISTRIBUTION OF AGRICULTURAL LABOUR FORCE AND TOTAL FOOD GRAIN PRODUCTION IN THE PUNJAB'S DISTRICTS, 1972



ALF, produce 8.1 and 6.5 per cent of its food grains respectively.

Growth of the ALF has a great bearing upon the per capita agricultural land and production as the land-labour relationship assumes new dimensions, particularly when the increase in the agricultural land is not proportionate to that in the ALF. Table 6.2 presents the distribution of net sown area per capita ALF in the Punjab's districts for the period 1951-72. As is clear, in 1951 the Punjab as a whole had 1.90 ha. of net sown area per capita of ALF and 10 districts had a higher average; but by 1961 an 18.4 per cent growth in the Province's ALF had caused a 4.2 per cent decline in its net sown area per capita ALF and in 8 districts the average exceeded the Province's 1.82 ha. There were marked regional contrasts in the change in the net sown area per capita ALF and six districts - Rawalpindi, Jhelum, Lahore, Sargodha, Mianwali and Jhang - experienced increases in this respect. The first three of these districts had actually registered decreases in their ALFs which resulted in inflating their per capita averages; while the last three had rapidly expanded their net sown areas - by 27.6, 40.1 and 34.8 per cent respectively - as a result of the irrigation development from the Jinnah Barrage. During the period 1961-72, the Province increased its total net sown area from 8,808,000 to 9,937,000 ha. or by 12.8 per cent, but its ALF rose by almost seven times as much - 87.1 per cent. The disproportionate increases in the land and labour resulted in a drop of 39.6 per cent in the per capita average - from 1.82 to 1.10 ha. All the districts experienced sharp declines, in nine the declines were sharper than that of the Province as a whole.

Although the total food grain production in the Punjab increased from 3,823,000 tonnes in 1951 to 4,237,000 in 1961 and 7,555,000 in 1972, or by 10.8 and 78.3 per cent in the two periods respectively, the food grain production per capita ALF declined by 6.4 per cent - from 0.94 to 0.88 - during the period 1951-61. However, seven districts experienced increases in this regard (Table 6.3). The situation during the period 1961-72 was different since the high yielding varieties of wheat, rice and maize enabled the districts to increase their food output rapidly and thus, despite a sharp increase in the ALF, the per capita

TABLE 6.2 DISTRIBUTION OF NET SOWN AREA PER CAPITA AGRICULTURAL LABOUR FORCE IN THE PUNJAB BY DISTRICTS, 1951-72

District	Net Sown Area Per cap. ALF (ha.)			% change		
	1951	1961	1972	1951-61	1961-72	1951-72
1.RWP	1.23	1.51	0.61	+22.8	-59.6	-50.4
2.CPR	2.44	2.04	1.32	-16.4	-35.3	-45.9
3.JLM	1.92	2.08	1.10	+ 8.3	-47.1	-42.7
4.GJT	1.77	1.61	1.07	- 9.0	-33.5	-39.5
5.SRG	2.44	2.67	1.56	+ 9.4	-41.6	-36.1
6.MWI	3.23	3.56	1.95	+10.2	-45.2	-39.6
7.JNG	2.29	2.45	1.09	+ 7.0	-55.5	-52.4
8.LYP	1.64	1.47	0.77	-10.4	-47.6	-53.0
9.LHR	1.12	1.34	0.79	+19.6	-41.0	-29.5
10.SLT	1.50	1.44	0.96	- 4.0	-33.3	-36.0
11.GWA	1.82	1.82	1.50	-	-17.6	-17.6
12.SHA	1.90	1.53	1.30	-19.5	-15.0	-31.6
13.MTN	1.98	1.95	1.09	- 1.5	-44.1	-44.9
14.SWL	1.80	1.67	1.02	- 7.2	-38.9	-43.3
15.MZG	1.62	1.58	1.01	- 2.5	-36.1	-37.7
16.DGK	1.83	1.32	1.25	-27.9	- 5.3	-31.7
17.BWP	1.97	1.60	1.14	-18.8	-28.8	-42.1
18.BWN	2.58	2.35	1.18	- 8.9	-49.8	-54.3
19.RYK	2.57	1.65	1.09	-35.8	-33.9	-57.6
PUNJAB	1.90	1.82	1.10	- 4.2	-39.6	-42.1

SOURCES:
1. As in Table 6.1
2. Statistics of West Pakistan - Agricultural Data 1947-8/1958-9
3. West Pakistan Agricultural Statistics 1954-5/1964-5
4. Punjab Agricultural Statistics 1965-6/1974-5 (8 vols)

production in the Punjab as a whole fell only by 4.5 per cent - from 0.88 to 0.84 tonnes. Seven districts- Sheikhupura, Gujranwala, Dera Ghazi Khan, Lahore, Sahiwal, Muzaffargarh and Sargodha - all of which benefited from the "Green Revolution", increased their per capita food productions.

6.3.4. A Typology of Labour-Land-Production Changes

In order to obtain a succinct picture of the relative changes in the major agricultural inputs and outputs, a three-dimensional typology of agricultural change was put together which takes into account the changes in the two principal inputs - labour and land; and one major output - food grain production, for the period 1951-72. The rates of change experienced by the districts in terms of three variables : agricultural labour force, total cropped area and total food grain production, were compared with the corresponding rates for the Province as a whole. The letter "A" indicates that the rate of change experienced by a district in terms of a variable was above the Province's rate of change, whereas "B" stands for 'below' Thus, in type "AAA" all the three rates were above and in type "BBB" all were below the Province's averages. As a result of this categorization, eight types of change emerged which are indicated together with computations in Table 6.4

Type AAA consists of three districts : Mianwali, Multan and Muzaffargarh, which, with 21 per cent of the Province's area, had 16.5 per cent of its population in 1951 and 17.7 per cent in 1972. Their share of the Province's total cropped area rose from 19 to 23.1 per cent; and cropping intensity from 79.5 to 90.8 in Mianwali, 96.8 to 117.1 in Multan and 86.5 to 95.2 in Muzaffargarh (Table 5.9). In Mianwali and Muzaffargarh, the newly canal irrigated areas after Independence attracted in-migration which enabled these districts to expand both their ALFs and their agricultural areas simultaneously. In the old canal colony district of Multan, however, the change in the total cropped area came mainly through intensification connected with the improved water supply from canals and particularly from tube wells. During the period in question, the three districts together experienced increases of 172.4, 68.7 and 119.4 per cent in their ALF, total cropped area and total food output respectively. The only district in the second type,

TABLE 6.3 FOODGRAIN PRODUCTION PER CAPITA AGRICULTURAL LABOUR FORCE IN THE PUNJAB BY DISTRICTS, 1951-72

District	Foodgrain Prod. Per cap ALF (tonnes)			% change		
	1951	1961	1972	1951-61	1961-72	1951-72
1. RWP	0.56	0.72	0.27	+28.6	-62.5	-51.8
2. CPR	1.05	0.95	0.54	- 9.5	-43.2	-48.6
3. JLM	0.89	1.02	0.43	+14.6	-57.8	-51.7
4. GJT	0.92	0.84	0.72	- 8.7	-14.3	-21.7
5. SRG	1.06	0.98	0.99	- 7.5	+ 1.0	- 6.6
6. MWI	0.78	0.69	0.59	-11.5	-14.5	-24.4
7. JNG	1.20	0.94	0.74	-21.7	-21.3	-38.3
8. LYP	1.01	0.98	0.87	- 3.0	-11.2	-13.9
9. LHR	0.41	0.56	0.77	+36.6	+37.5	+87.8
10. SLT	0.88	0.90	1.01	+ 2.3	+12.2	+14.8
11. GWA	1.25	1.41	2.08	+12.8	+47.5	+66.4
12. SHA	1.35	1.05	1.59	-22.2	+51.4	+17.7
13. MTN	1.07	1.07	0.90	-	-15.9	-15.9
14. SWL	1.00	0.92	1.04	- 8.0	+13.0	+ 4.0
15. MZG	0.91	0.68	0.72	-25.3	+ 5.9	-20.9
16. DGK	0.87	0.55	0.78	-36.8	+41.8	-10.3
17. BWP	0.61	0.72	0.64	+18.0	-11.1	+ 4.9
18. BWN	0.68	0.76	0.56	+11.8	-26.3	-17.6
19. RYK	0.98	0.62	0.57	-36.7	- 8.1	-41.8
PUNJAB	0.94	0.88	0.84	- 6.4	- 4.5	-10.6

SOURCES : As in Table 6.2

AAB - Jhang - could well be in the first category with similar trends in the growth of its ALF and total cropped area but lagged somewhat behind the Provincial rate of change in terms of the third component of the typology - food grain production.

Type ABA comprises two districts - Bahawalpur and Bahawalnagar where, connected with in-migration and natural increase, the ALF rose rapidly but the total cropped area increased at a slower rate than the Provincial average. In Bahawalpur, owing to the horizontal growth, total cultivated area increased by 26.6 per cent compared with 22.5 per cent for the Province as a whole and 12.1 per cent for Bahawalnagar. But, although their total cropped areas rose slowly in the wake of their low cropping intensities, these districts increased their food output at a higher rate than the Province as a whole.

The two districts - Rawalpindi and Rahimyar Khan - of type ABB, experienced high growth rates of ALF - 145.3 and 204.0 per cent respectively - but scored low in terms of the other components of the typology. The two districts, however, constitute a special case, since the sharp rises in their ALFs are linked with territorial adjustments and the resulting population transfers. For the development of the new national capital, Islamabad, on the territory of the Rawalpindi tehsil, an area of 907 sq.km.was transferred, after 1961, from the tehsil to the Federal Capital Territory Islamabad (FCTI). Then, in order to compensate the tehsil's 'lost' area, 953 sq.km. of land containing 98 villages with approximately 103,000 population was transferred to Rawalpindi tehsil from the adjoining Fatehjang tehsil of the Campbellpur district. Similarly, an area of 243 sq. km. was transferred from the Sukkur district of Sind to Sadiqabad tehsil of the Rahimyar Khan district. These transfers, no doubt, inflated the rural populations and the ALFs in these districts; and without these "spurious" increases in their ALFs, these districts could well be in type BBB, with all the three rates of change below those of the Province as a whole.

To sum up, there are four categories in the 'labour-land-production' typology, consisting of eight districts, where the increases in the ALF were high, ranging between 161.7 and 213.8 per cent (Table 6.4). But in only three of these

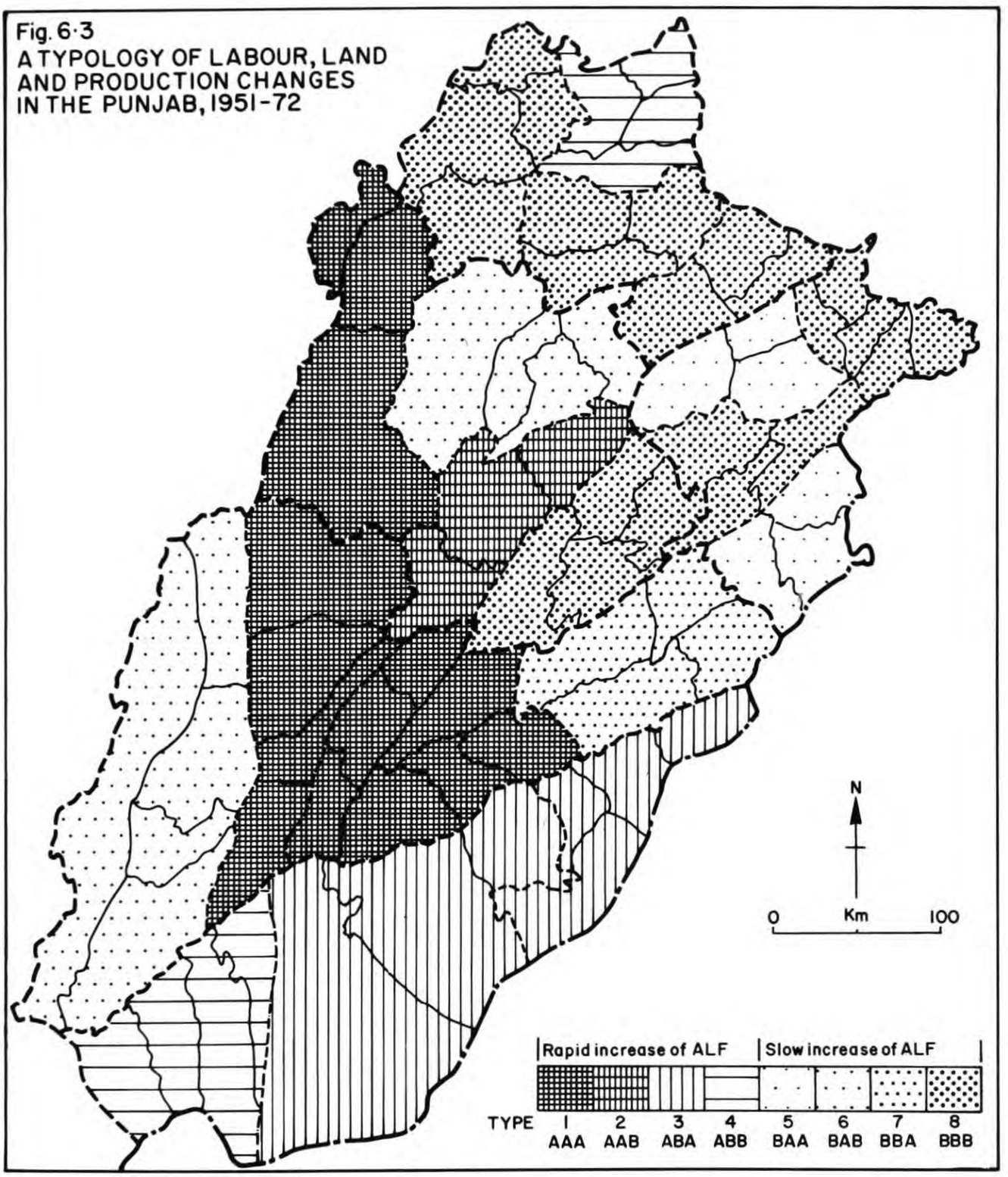


Fig. 6·3
A TYPOLOGY OF LABOUR, LAND AND PRODUCTION CHANGES IN THE PUNJAB, 1951-72
N
0
Km
100
Rapid increase of ALF
Slow increase of ALF
TYPE
1 AAA
2 AAB
3 ABA
4 ABB
5 BAA
6 BAB
7 BBA
8 BBB

TABLE 6.4

LABOUR-LAND-PRODUCTION TYPOLOGY IN THE PUNJAB, 1951-72

Type*	1951				1972				% change 1951-72			
	Tot.Pop. 000	ALF 000	T.Crop Area 000 ha	Food Prod. 000 t.	Tot.Pop. 000	ALF 000	T.Crop Area 000 ha	Food Prod. 000 t.	Tot.Pop.	ALF	T.Crop Area	Food Prod.
AAA	3,409	714	1,611	701	6,668	1,945	2,718	1,538	95.6	172.4	68.7	119.4
AAB	877	167	384	200	1,561	524	597	388	78.0	213.8	55.5	94.0
ABA	1,159	261	724	168	2,145	683	891	406	85.1	161.7	23.1	141.7
ABB	1,573	329	670	247	3,147	895	847	381	100.1	172.0	26.4	54.3
BAA	2,942	465	726	350	5,834	779	1,165	988	98.3	67.5	60.5	182.3
BAB	1,794	394	916	392	3,243	810	1,344	737	80.8	105.6	46.7	88.0
BBA	1,816	373	781	374	2,837	819	1,077	855	56.2	119.6	37.9	128.6
BBB	7,081	1,374	2,645	1,391	12,175	2,579	3,175	2,262	71.9	87.7	20.0	62.6
PUNJAB	20,651	4,077	8,457	3,823	37,610	9,034	11,814	7,555	82.1	121.6	39.7	97.6

* For explanation see the text

SOURCES : 1. As in Table 6.2
2. District Census Reports 1972 (19 vols)

districts, the increases in land and production were proportionately high; in another the change in production was slow; in another two change in land was slow; and in two districts the ALFs were inflated by extraneous factors (Fig.6.3).

Slow changes in the size of the ALF were, on the other hand, experienced by eleven districts but only in six districts of type BBB, i.e. Campbellpur, Jhelum, Gujrat, Lyallpur, Sialkot and Sheikhupura, were the changes in land and production proportionately slow. In Sahiwal, despite a low rate of increase in the ALF and land, that of food production was quite rapid - 128.6 per cent compared with the Province's 97.6 per cent - mainly because of mechanization and other factors associated with the "Green Revolution". In Lahore and Gujranwala, slow increase of the ALF was associated with high increases of land and production mainly due to intensification and increased water supply. Although Lahore and Gujranwala increased their total cultivated areas by 5.7 and 23.3 per cent respectively between 1951 and 1972, their total cropped areas rose by 66.0 and 55.9 per cent and cropping intensities from 84.8 to 133.2 and 101.5 to 128.4 respectively and, with improved seeds, increased water supply and a high level of mechanization, they together increased their food output by 182.3 per cent - the highest among the eight types and almost twice as rapidly as the Punjab as a whole. In the two districts of BAB type,the slow increase of the ALF was associated with the slow increase of production but high increase of land - mainly because of horizontal growth of the agricultural area in the wake of newly developed canal irrigation systems.

Broadly speaking, the eight districts, where the rate of increase in the ALF between 1951 and 1972 was higher than the overall Provincial rate, together experienced an increase of 92.7 per cent in their total population, 175.1 per cent in their ALF, 49.1 per cent in their total cropped area and 106.2 in food production. Their share of the Province's totals rose from 34 to 36, 36.1 to 44.8, 40.1 to 42.8 and 34.4 to 35.9 per cent in terms of these variables respectively. The eleven districts which experienced growth rates of the ALF below

the Provincial average, together increased their total population by 76.7 per cent; and the ALF, total cropped area and total food production by 91.4, 33.4 and 93.1 per cent respectively. The disparity between the two broad regions in these rates of growth brings out, more than anything, that the higher rate of population increase is associated with the greater change in agricultural production.

6.4. CORRELATION ANALYSIS

Although capable of modification and alteration, the above typology nonetheless gives an idea of the association between agricultural and population changes in terms of three important variables. For a closer look on the inter-relationships of agricultural and population changes in the Punjab, a correlation analysis was conducted for the 19 districts between a large number of population and agricultural variables - among them population density and agricultural intensity. Geographers have used a variety of quantitative methods for investigating relationships between different variables. A commonly employed measure for establishing the direction and strength of the relationship between two variables is the coefficient of correlation.

The two major types of correlation coefficient are the Pearson product-moment correlation coefficient (r), normally used for variables measured on an interval or ratio scale; and the Spearman rank correlation coefficient (r_s), used to measure the relationship between two sets of ordinal values. The value of correlation obtained with both these coefficients varies between +1 (perfect positive) and -1 (perfect negative).

In the present study, correlation between various variables was measured by the Pearson product-moment correlation coefficient (r). The results in the case of some selected variables are set out in Table 6.5 showing the strength of linear relationships.

As is clear from Chapters IV and V, marked regional contrasts are characteristic of population density and agricultural intensity in the Province.

Boserup defines agricultural intensity as the frequency with which a given area is cropped,and uses the crop-fallow cycle as its index. The measure used in the present study is, however, much more simple. It is the total cropped area per unit of total cultivated area and shows the extent to which the cultivated area is used for cropping, reflecting the incidence of single or double cropping. Level of mechanization can be measured in numerous ways but, limited by the availability of data, in the present study it is indicated by the percentage of farm households reporting the use of a tractor. Dependency ratio is the ratio of populations aged 0-14 plus 65+ to population aged 15-64.

Table 6.5 gives coefficients of correlation between 26 variables,of which 14 are population variables. The values of variables pertain to 1972 in the case of population and to the average of 1970-1/1974-5 for agriculture; the changes are for the periods 1961-72 and 1958-9/1962-3 to 1970-1/1974-5 respectively. In order to be significant, the coefficient of correlation in the present analysis has to be 0.46 at 5 per cent level and 0.58 at one per cent level, with 17 degrees of freedom. To have a graphic view of the amount of correlations and their regional variations, scatter diagrams are plotted for various pairs of variables. In all such cases population variables are taken along independent(horizontal)axes.

It is common knowledge that population and development have, in most cases, a strong interconnection and interaction. As an example, it may be argued that development might cause a decline in religious interest and the traditional values and a break up of the traditional extended family system which may, in turn, have a considerable impact on the family pattern of a society. Similarly, development may stimulate the process of urbanization and the diffusion of education which may in turn improve living standards and socioeconomic status, particularly of women. This may result in shrinking family size and ultimately in lowering the society's fertility level. Development might also cause a decline in mortality, particularly infant mortality, through improvement in health care. The changes in fertility and mortality may result in the changed overall population growth which may then have a considerable bearing upon the development process.

TABLE 6.5 COEFFICIENTS OF CORRELATION BETWEEN SELECTED POPULATION AND AGRICULTURAL VARIABLES FOR THE PUNJAB'S 19 DISTRICTS, 1972

Agricultural Variables / Population Variables	Tot. Population	Rur. Population	Arith. Density	Rur. Density	T. Dependency Ratio	R. Dependency Ratio	Net in-migration	Rate of Net in-migration	Agri. Lab. Force	% change Tot.Pop.	% change Rural Pop.	% change ALF	Change Arith. Density	Change Rur. Density
Net Sown Area	0.55	0.72	0.01	0.14	0.27	0.23	0.45	0.22	0.82	-0.09	0.07	0.25	-0.01	0.14
Cropping Intensity	0.67	0.52	0.81	0.79	0.01	0.07	0.71	0.68	0.30	0.30	0.12	-0.23	0.80	0.75
Area under Foodgrains	0.72	0.83	0.51	0.70	0.22	0.17	0.63	0.45	0.66	0.30	0.37	-0.01	0.50	0.71
Foodgrain Production	0.79	0.91	0.41	0.58	0.30	0.26	0.75	0.51	0.82	0.20	0.29	-0.01	0.41	0.58
Per capita Food Production (Tot. Pop)	0.41	0.31	-0.20	0.05	0.66	0.53	0.06	0.18	0.25	-0.01	0.34	-0.11	-0.19	0.12
Per capita Food Production (Rur. Pop)	0.31	0.35	0.15	0.20	0.58	0.57	0.37	0.43	0.28	0.20	0.30	-0.12	0.18	0.23
Av. Farm Size	-0.33	-0.25	-0.57	-0.59	0.36	0.35	-0.33	-0.29	-0.12	-0.25	-0.04	0.05	-0.55	-0.55
Level of Mechanization	0.73	0.68	0.73	0.78	0.11	0.14	0.77	0.63	0.46	0.30	0.21	-0.27	0.73	0.77
% Change Net Sown Area	-0.12	-0.03	-0.31	-0.32	0.63	0.62	-0.10	-0.02	0.09	0.42	0.59	0.30	-0.25	-0.21
Change Cropping Intensity	0.55	0.31	0.55	0.35	0.29	0.42	0.53	0.30	0.15	0.34	0.24	-0.40	0.57	0.33
% Change Foodgrain Area	0.38	0.16	0.52	0.33	0.44	0.55	0.44	0.48	0.10	0.50	0.37	-0.07	0.55	0.34
% Change Foodgrain Production	0.34	0.27	0.22	0.12	0.66	0.72	0.36	0.36	0.30	0.37	0.40	0.10	0.25	0.15

SOURCE : Computed by the author

Similarly, in a developing but predominantly agricultural country, where agriculture not only contributes an overwhelming share of national income but also absorbs a large part of the work force, the interaction between population growth and agricultural change is of great interest. For instance, population growth due to natural increase or migration has a great bearing on the growth of the labour force and, even though other factors remain constant, growth of labour force may be of great consequence through its influence on the total, per capita and per worker output. There could, of course, be a limit to which agriculture will absorb the growing labour force without drastic reductions in productivity per worker or per capita. Beyond that limit agriculture may compel its unemployed work force to emigrate - to other agricultural areas or to urban areas. The redundant agricultura labour might accumulate in the urban places. Then a period could come when, with the growing tide of rural-urban migration, the agricultural sector suffers from shortage of labour and, as a result, there could be food shortage and a rise in food prices. Thus the relation of demand and supply is upset, which then necessitates adjustments and changes in the consumption-employment cycle as also in cultivated area, intensity of cropping, cropping patterns, use of fertilizer and other productivity raising techniques - all aimed at increasing the total, per capita and per worker production.

The introduction and success of such changes, however, depends on a multitude of factors : e.g., local supply conditions, institutional set-up, sociocultural climate, strength of the non-agricultural sector and, above all, resource endowment. As the inability of the agricultural sector to support growing numbers compels people to move to non-agricultural activities in situ, lack of productive employment opportunities in the non-agricultural sector is likely to result in emigration. Thus, a change in a country's population may trigger off numerous changes and adjustments in its agriculture; and existence or lack of potential for these changes may, in turn, have a bearing on population growth, particularly in terms of the labour force and especially on a regional level. Having spelled out the probable nature of the associations between population

growth and agricultural change, we now focus on the question whether some systematic pattern of relationships between the two families of variables emerges from the experience of the Punjab and its districts.

6.4.1. Population and Net Sown Area

It was stated in Section 4.3 that, since agriculture is the principal economic activity in the Punjab, the pattern of population distribution is closely associated with the exploitation of agricultural resources. Thus, the larger the agricultural area of a district, the bigger is its population size. This was reflected by a positive coefficient of correlation between total population and total cultivated area ($r = +0.47$), net sown area (+0.55) and total cropped area (+0.68). Then, for obvious reasons, the values of correlation were higher between rural populations of districts and the above types of agricultural areas - +0.65, +0.72 and +0.81 respectively. The correlation analysis further revealed a high positive correlation between agricultural labour force and total cultivated area ($r = +0.76$), net sown area (+0.82) and total cropped area (+0.85).

Although, generally, there is a tendency for a high degree of association between the two variables, an examination of the scatter diagram (Fig.6.4 (a)) reveals some interesting variations in the pattern of association between net sown area and rural population. The three districts - Lyallpur, Multan and Sahiwal - with the largest rural populations together have the largest share of the Province's net sown area. But, although in Multan and Sahiwal the shares of the Province's net sown area - 10.9 and 8.4 per cent respectively - closely correspond with their shares of rural population - 11.0 and 8.6 per cent, Lyallpur's share of the Province's net sown area (7.0 per cent) is much less than its share of rural population (11.2 per cent). This creates an impression of agricultural over-population and the consequent population pressure in the district; and is reflected in its lowest net sown area per capita total population among the three districts - 0.17 ha. compared with 0.27 in Multan and 0.29 in Sahiwal (Table 5.7); and also in its lowest net sown area per capita ALF - 0.77 ha. against Multan's 1.09 and Sahiwal's 1.02 (Table 6.2). This population pressure in Lyallpur, however, seems

Fig 6·4

SCATTER DIAGRAMS

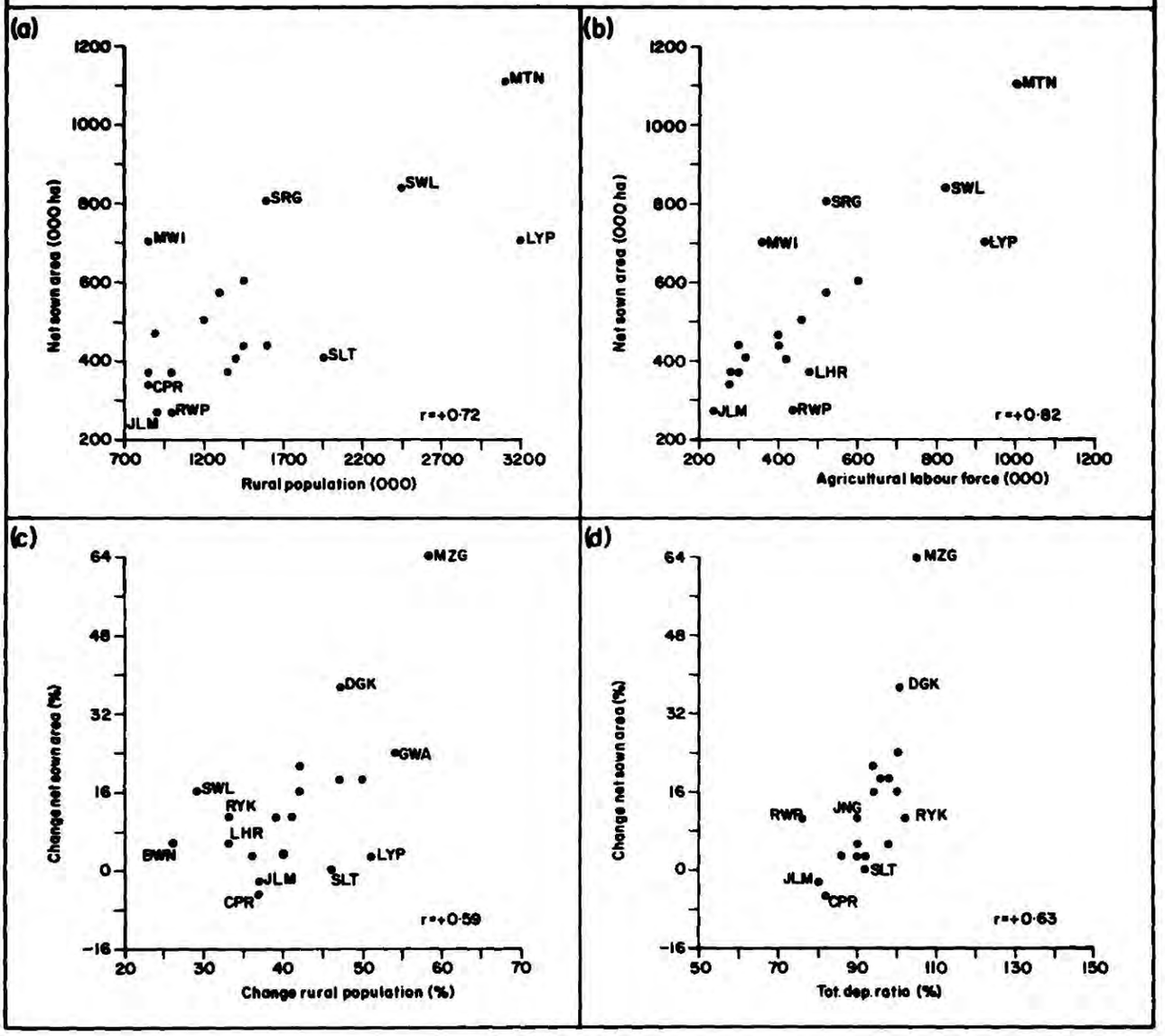
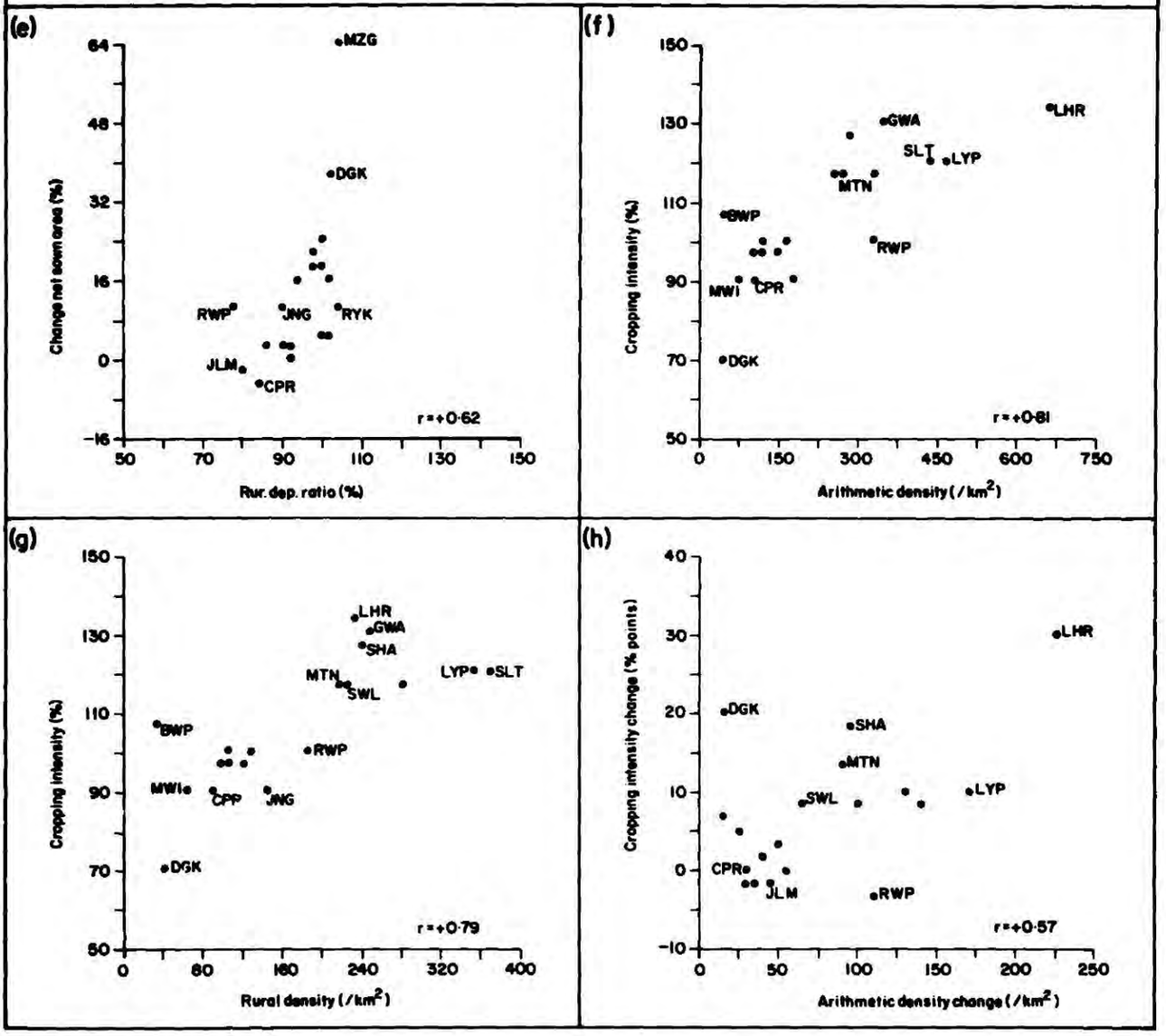


Fig 6·4 (Cont.)

SCATTER DIAGRAMS



to have prompted intensification of agriculture and the district's cropping intensity (121.2) is higher than that of Multan (117.1) and Sahiwal (117.7).

Interesting variations from the general pattern are also shown by Mianwali, Sargodha and Sialkot. The first expanded its net sown area in the wake of canal irrigation development after Independence at a much faster rate than its population. It contains, despite a high degree of in-migration, only 3 per cent of the Province's rural population on 6.9 per cent of its net sown area. A large part of Sargodha also benefitted from the post-Independence canal irrigation expansion, but in this case most of the settlers of the newly opened areas came from within the district. The district also experienced out-migration to other relatively more fertile old canal colony areas. It now has 5.7 per cent of the Province's rural population and 8.1 per cent of its net sown area. Since they have proportionately higher shares of the Province's net sown area than of its rural population, Mianwali and Sargodha have some of the lowest cropping intensities - below the Province's average of 106.3. Despite the highest intensity of land use in the Province - 97.2 per cent - Sialkot, with 6.9 per cent of the Province's rural population and 4.1 per cent of its net sown area, has a similar position to that of Lyallpur. And in response to its growing agricultural overpopulation the district has rapidly increased its cropping intensity - from 97.6 in 1951 to 113.7 in 1961 and 121.6 in 1972.

As regards the ALF and net sown area, in general there is a tendency towards a high correlation between the two variables ($r = +0.82$). Important variations from the general pattern are, however, shown as before by Multan, Lyallpur, Mianwali and Sargodha. In addition, notable departures are made by Lahore and Rawalpindi which, with 4.8 and 3.4 per cent of the Province's rural population, contain 5.3 and 4.9 per cent of its ALF and 3.8 and 2.7 per cent of its net sown area respectively. Lahore, with the highest cropping intensity in the Punjab - 133.2 - has the third highest concentration of the ALF per unit net sown area - after Rawalpindi and Lyallpur; whereas in Rawalpindi the size of the ALF is exaggerated due to territorial adjustments after 1961 (Section 6.3.4).

Figure 6.4 (c) portrays the relationship between the percentage changes in net sown area and rural population during the period 1961-72, showing a moderate degree of correlation (r = +0.59) between the two variables. The highest increase in rural population (57.6 per cent) in Muzaffargarh is associated with the highest rate of increase in the net sown area (63.5 per cent). Dera Ghazi Khan, which had the second highest increase in net sown area in the Province (36.7 per cent), increased its rural population relatively slowly - by 46.6 per cent. Two districts - Campbellpur and Jhelum - which experienced decreases of 6.5 and 1.8 per cent in their net sown areas during the period in question, increased their rural populations at relatively slow rates of 36.7 and 37.3 per cent. In Sialkot too the net sown area declined by 0.5 per cent but the district's rural population rose by 46.1 per cent and this disparity acted as a catalyst for increasing cropping intensity. A similar situation was faced by Lyallpur which, with a minimal increase of 3.9 per cent in net sown area but with one of the highest increases in rural population - 51.1 per cent, increased its cropping intensity sharply. The districts where slow rates of rural population increase were associated with the slow rates of increase in net sown areas were Bahawalnagar and Lahore. However, in Sahiwal a low rate of rural population increase (29.2 per cent) was associated with a moderately high rate of increase in net sown area (16.2 per cent), which was caused by out-migration of cultivators and land owning class to the newly opened areas both within and outside the Province.

It can be argued from the above that substantial changes in the net sown area may be expected in the districts of high population pressure. A judgement of the state of population pressure is however subjective and mostly qualitative. It is difficult to formulate an appropriately uniform concept of population pressure. Even the measures of population pressure may adopt different meanings in different regions or at different times in the same region. Boserup uses population density as a measure of population pressure and various studies conducted within her framework mostly followed this practice (Section 6.2). A recent study investigated the relationship between population pressure and

intensity of cropping in an Indian region, also using population density - albeit rural density - as a measure of population pressure. (53) In the present study, besides the measures mentioned above, total dependency ratio (TDR) and rural dependency ratio (RDR) are also taken as indices of population pressure.

Figure 6.4 (d) depicts relationship between the rate of change in net sown area for the period 1961-72 and TDR of districts in 1972. In general, there is a tendency for a fairly strong association between the two variables ($r = +0.63$). However, Muzaffargarh and Dera Ghazi Khan, with the highest values of both variables, make a significant departure from the general pattern. A closer examination further reveals three distinct patterns in the relationship. First, a cluster of five districts - Gujrat, Sargodha, Lyallpur, Lahore and Bahawalnagar - where a relatively low rate of increase in net sown area is associated with a relatively low TDR. The increase in net sown area in these districts between 1961 and 1972 was 1.9-4.7 per cent and their TDRs in 1972 varied between 86.5 and 98.4 per cent. The second category comprises three districts : Rawalpindi, Jhang and Rahimyar Khan where, although TDR varied considerably - 76.3 in Rawalpindi, 89.0 in Jhang and 102.9 in Rahimyar Khan - the change in net sown area was nearly equal - 11.3 per cent. The third element is made up of six districts (Mianwali, Gujranwala, Sheikhupura, Multan, Sahiwal and Bahawalpur) where the values of both variables are moderately high.

Agricultural conditions are more sensitive to rural population change. But when it comes to population pressure, total population - a composite of rural and urban populations - is capable of exerting greater pressure and thus evoking stronger response. This is reflected in a slightly lower coefficient of correlation (+0.62) between the rate of change in net sown area and RDR. However the graphic pattern of this relationship is almost similar to the preceding (Fig. 6.4 (e)).

Given the problems of data comparability,it was not possible to compute the changes in TDR and RDR during the period 1961-72 and then to test those against the changes in net sown area. However, it can be concluded from the above that

there exists a fairly high association between population pressure and change in agricultural areas.

6.4.2 Population and Cropping Intensity

Cropping intensity is a useful index of a region's effort to respond to and combat its mounting population pressure by making the maximum use of a parcel of land. It is argued that, as per capita cultivated area declines with the growth of population, the farming class increases the intensity of cropping in order to compensate for that decrease particularly when horizontal addition to the agricultural area is not possible. This is why the relationship between population pressure and cropping intensity occupies a focal position in a study of the inter-relationship between population and agricultural change. A positive correlation between population pressure and cropping intensity is fundamental to Boserup's schema and this has been amply testified by various other studies (Section 6.2). The present analysis revealed that cropping intensity is fairly strongly or strongly correlated with : total population ($r = +0.67$), rural population (+0.52), arithmetic density (+0.81), rural density (+0.79) and net in-migration (+0.71).

Figure 6.4 (f) presents a graphic view of the association between cropping intensity and arithmetic density in the Punjab's 19 districts. In general, there is a tendency for the high values of cropping intensity to be associated with the high values of arithmetic density and vice versa. Lahore with the highest arithmetic density in the Province ($654/km^2$) has the highest cropping intensity (133.2) and, at the other end of the scale, Dera Ghazi Khan demonstrates an association between the lowest value of cropping intensity (68.9) with the second lowest of arithmetic density (47). A clearer picture of the association between population pressure and agricultural change is provided by Figure 6.4(g) which depicts the relationship between cropping intensity and rural density. A few revealing patterns of association are discernible from the scatter. 1) A group of three districts - Lahore, Gujranwala and Sheikhupura - where the highest cropping intensities (126.4 - 133.2) are associated with high rural densities

(234-245/km^2). 2) A set of two districts - Sialkot and Lyallpur - with the highest rural densities in the Province (366 and 350/km^2) and high cropping intensities (121.6 and 121.2). 3) A set of two districts - Sahiwal and Multan - with high rural densities (224 and 214/km^2) and high cropping intensities (117.7 and 117.1). 4) A group of five districts - Jhelum, Sargodha, Muzaffargarh, Bahawalnagar and Rahimyar Khan - with low rural densities (99-130/km^2) and low cropping intensities (95.2-100.4). 5) A set of two districts - Mianwali and Campbellpur - with the lowest rural densities (61 and 88/km^2) and the lowest cropping intensities (90.8 and 91.6).

Change in cropping intensity during the period 1961-72 has a moderately high correlation with the change in arithmetic density during that period ($r = +0.57$). Marked variations from the general pattern are exhibited by Lahore, where highest changes in the two values are associated; Dera Ghazi Khan, where the second highest change in cropping intensity is associated with the smallest change in arithmetic density; and Rawalpindi, where one of the highest density changes is linked with a decline in cropping intensity. Besides Rawalpindi, in four districts - Campbellpur, Jhelum, Bahawalnagar and Rahimyar Khan - the density changes were among the smallest in the Province and these were linked with declines in cropping intensities. Two of these districts - Campbellpur and Jhelum - are unirrigated, while in Bahawalnagar and Rahimyar Khan 91.5 and 97.2 per cent respectively of the total cropped area is irrigated.

To summarize, cropping intensity is strongly correlated with population density (or population pressure) in the region. Thus there is a tendency for high density areas to have a generally higher level of cropping intensity. However, the changes in the values of the two variables do not exhibit similar strength in their correlation. This is explicable in terms of the variation in other influences on agriculture such as physical inputs - particularly water. Thus, whereas the mounting population pressure has prompted change in agricultural methods and performance, the actual change has been influenced by the availability of water. In fact, there have been varied responses to population pressure. As a

first step, the districts with growing population pressure have usually expanded their agriculture into hitherto uncultivated areas, given the availability of inputs such as water. Secondly, the districts have increased their net sown areas and, as a third step, intensification has taken place.

6.4.3. Population and Foodgrain Area and Production

As described in Section 5.5.4, more than half of the Punjab's total cropped area is under food grains. At the district level, the percentage of area under food grains varies between 33.6 per cent in Mianwali and 83 per cent in Campbellpur. The importance of food grains can also be gauged from the fact that, in deciding what crops to grow in a particular year, a farmer almost always gives first preference to food grains. Thus area under food grains has a strong correlation with : total population ($r = +0.72$), rural population (+0.83) and agricultural labour force (+0.66). That population and food production are closely associated was underscored in Section 4.3 and also shown in Table 6.5. Let us now examine some of the variations in these relationships.

Figure 6.5(a) presents a graphic view of the correlation between rural population and food grain production in the Punjab's 19 districts. There is a very high degree of association between the two variables. The old canal colony districts - Lyallpur, Multan and Sahiwal, with large scale tube well irrigation, higher level of mechanization and a greater use of better seeds and modern inputs, contain the largest rural populations linked with the highest production of food grains. The Potwar districts of Rawalpindi, Campbellpur and Jhelum, on the other hand, contain the lowest sizes of rural population and with the lowest level of irrigation and almost negligible use of modern inputs produce the lowest quantity of food grains. A closer examination of Figure 6.5(a) reveals two markedly different models. The first comprises six districts - Gujranwala, Sheikhupura, Sargodha, Muzaffargarh, Jhang and Lahore - where a relatively high food grain production linked with large scale use of the "Green Revolution" technology is associated with medium sized rural populations. The second model consists of

Fig 6·5

SCATTER DIAGRAMS

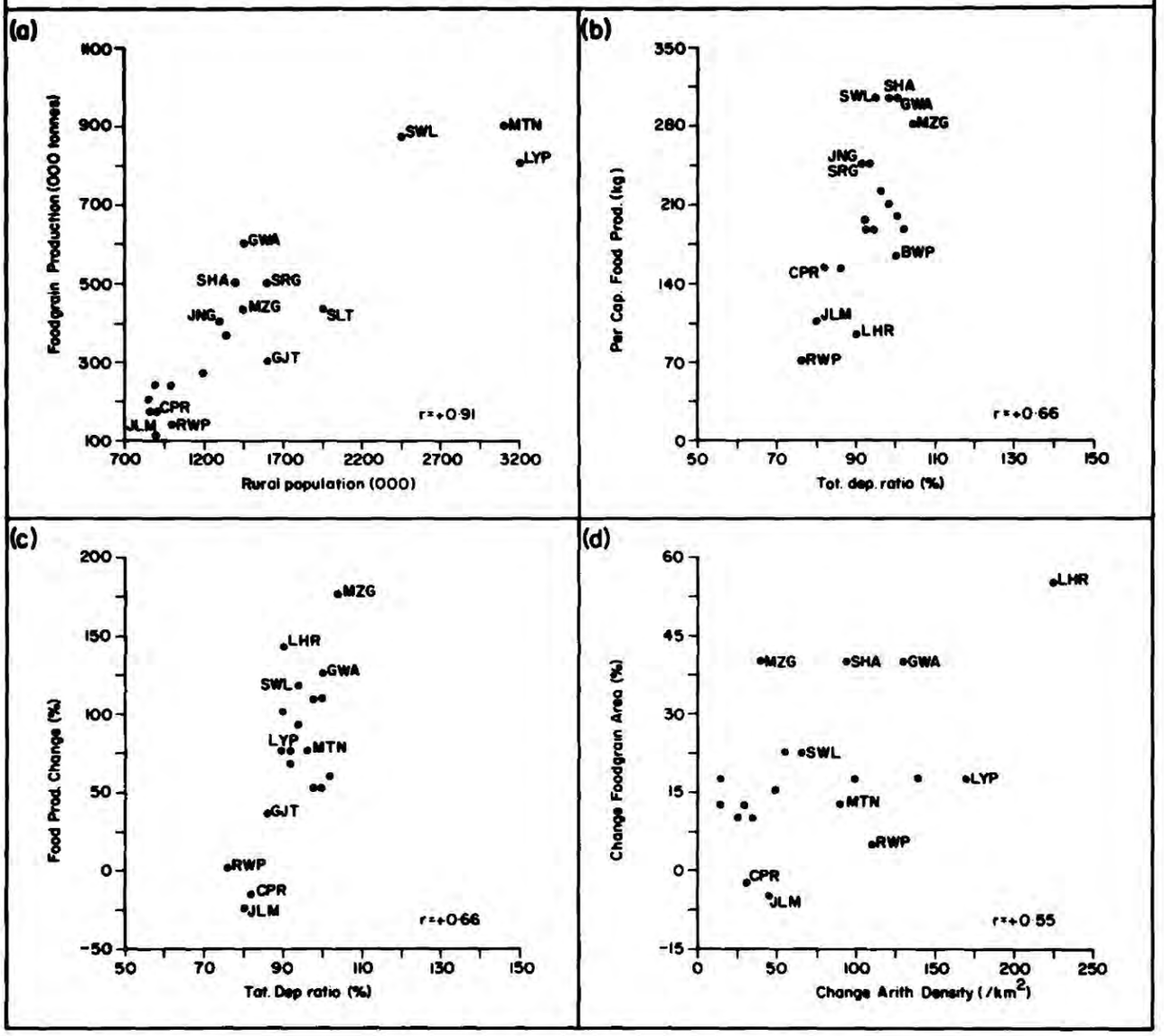
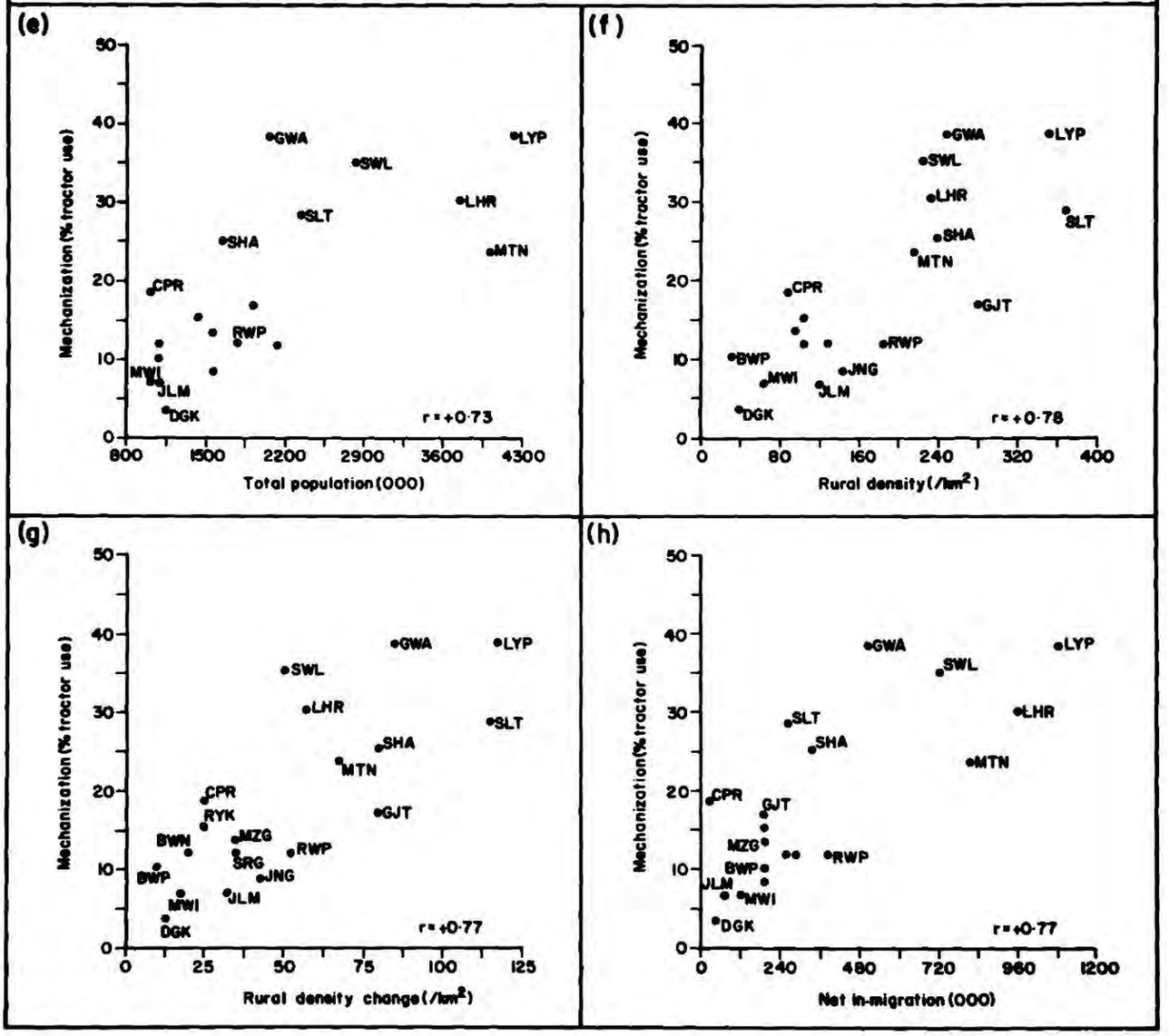


Fig 6·5 (Cont.)

SCATTER DIAGRAMS



Mianwali, Dera Ghazi Khan, Bahawalpur and Bahawalnagar, which in the wake of increased water supply - mainly from canals - have increased their food output but, despite in-migration, have relatively smaller rural populations. Besides, the major emphasis of the in-migrant farmers to the newly opened areas seems to be on food grain production and they almost always start reclamation of hitherto uncultivated land by growing food grains. This is reflected in a high correlation between net in-migration and food grain production ($r = +0.75$).

That per capita food production is generally higher in the areas of high population pressure and vice versa is demonstrated by a fairly strong correlation between total dependency ratio (TDR) and food grain production per head of total population ($r = +0.66$). Notable variations from the general pattern are shown by : 1) Gujranwala, Sheikhupura and Sahiwal where the highest per capita food grain production is associated with high TDRs. The production varies between 298 and 301 kg. compared with 201 of the Province as a whole; and TDRs range between 94.3 and 99.2 compared with 92.6 of the Punjab as a whole. 2) Bahawalnagar, Dera Ghazi Khan and Rahimyar Khan where the TDRs are among the highest (99.5-102.9) and food production per capita of a medium order (187-209 kg). 3) Mianwali, Lyallpur and Sialkot where the TDRs are between 91.3 and 94.5 and per capita food production 182-190 kg. (Fig. 6.5(b)).

Total dependency ratio demonstrates the same strength of correlation ($r = +0.66$) with the change in food grain production as it does with per capita food production. However, there are minor variations in the graphic patterns of the association, and three distinct patterns emerge : 1) Gujranwala, Sheikhupura, Sahiwal and Dera Ghazi Khan which due to the reclamation of water logged land and increased water supply and under a high population pressure experienced one of the highest increase in food output; 2) Sargodha, Lyallpur, Multan and Sialkot where the availability of water increased sharply but, linked with medium levels of TDRs, the increases in food output were not high; and 3) the trans-Sutlej districts of Bahawalpur, Bahawalnagar and Rahimyar Khan with the highest TDRs but moderate increases in foodgrain production linked with a relatively low level of ground

water exploitation (Fig. 6.5 (c)).

Figure 6.5(d) portrays the association between changes in food grain area and arithmetic density experienced by the Punjab's districts between 1961 and 1972. In general, there is a moderately high correlation (r = +0.55) but important variations are shown by Lahore, where the highest values of the two variables are associated; and by Campbellpur and Jhelum, which experienced the lowest changes in terms of both variables. In Lahore, the mounting population pressure was one of the forces of agricultural change while the other two districts with the lowest density changes, and inadequate water supply in their rain-fed agriculture, experienced declines in the food grain areas.

6.4.4. Population and Modern Agricultural Technology

Although the application of chemical fertilizer in Pakistan started in 1952, it increased sharply in the mid-1960's together with the introduction of high yielding fertilizer-responsive seeds in the wake of increased water supply via tube well development. This was the period when tractor use also demonstrated a sharp increase, thus marking the beginning of any significant mechanization in Pakistan's agriculture. An investigation into farm mechanization and agricultural development in the Punjab revealed that 93 per cent of the tractors in 1968-9 were on farms with irrigation; and as the installation of a tube well on a canal irrigated farm provided a very reliable water supply system, 63 per cent of all tractors were on farms with both tube well and canal water, 20 per cent on the perennial canal irrigated farms and 10 per cent on the farms with only tube well water. (54) The present study confirmed these findings : moreover, there is a markedly high correlation between the modern inputs indicating that the use of chemical fertilizer and tractors is common only where the constraint of water has been removed (Section 5.7). Thus, whereas population pressure provided a necessary inducement for the region's better agricultural performance during the 1960's,water provided the important physical infrastructure for the overall change and for a more efficient utilization of other inputs.

It follows from the above that tractor use can be taken as an index not only of mechanization but also of the use of all modern inputs. Although data on a district basis regarding the number of tractors are available since the late 1960's, it is only through the 1972 Census of Agriculture that the number of households reporting the use of a tractor is known. According to this source, 20.4 per cent of the Punjab's farm households reported use of tractor. At the district level, the figure varied between 3.4 in Dera Ghazi Khan and 38.2 in Gujranwala. In all, in seven districts - Gujranwala, Lyallpur, Sahiwal, Lahore, Sialkot, Sheikhupura and Multan - the level of tractor use was higher than that of the Punjab as a whole.

Figures 6.5 (e-h) present a graphic view of the association between the level of tractor use and various population variables in the Punjab's districts. Generally the highest level of tractor use is associated with the highest values of population variables with the seven above mentioned districts standing out. Six out of these districts - except Sheikhupura - have the highest ranks in total population and five - except Sheikhupura and Lahore - also lead in rural population. Together they occupy 28 per cent of the Province's area and contain 55.6 per cent of its total and 52.6 per cent of its rural population. In addition, with 85 of the Province's 202 urban places, they contain almost two thirds of its urban population. Four of the districts have the highest level of urbanization, five the highest arithmetic density and six the highest rural density in the Province. Situated in a contiguous block in the central doabs - Rechna and Bari - all of them except Sialkot occupy the old canal irrigated tracts where major tube well installations during the 1960's have also taken place linked, in five of them, with the highest rates of population increase between 1961 and 1972. The large number of their almost uniformly spread urban places not only act as catalysts for agricultural expansion but also provide ample opportunities for machine purchase and repair. Thus, benefitting from a better overall social climate and provided with adequate physical infrastructure, such as water, these districts have adopted modern technology at a faster rate than others.

6.5. SUMMARY AND CONCLUSION

This chapter has examined the interrelationships between population and agriculture in the Punjab's districts with emphasis on the changes experienced in terms of the two families of variables during the period 1961-72. The chapter opened with a review of the related concepts. The relationship between population and agriculture - whether agriculture can provide food for growing population and absorb it in active employment - has been one of the most debated points since the time man became conscious of his immediate needs and problems and particularly his well-being. Malthus was one of the first to consider the relationship between population and well-being in a scientific manner. But his views, about the inelasticity of food supply, about a disparity between population numbers and food supply acting as a "brake" in the form of "vice and misery", or about intensification of agriculture via increased labour supply resulting in diminishing returns, were all fiercely challenged. However, many economists and population scientists recast or reasserted his views by underscoring the adverse effects of population growth on economic development. In contrast to this is the argument propounded mainly by Clark and Boserup that population growth is independent of food supply and population pressure acts as a catalyst for economic improvement. Various studies undertaken on these lines in different regions lend support to the views of Clark and Boserup by underscoring a strong relationship between the mounting population pressure and agricultural improvement.

In its second part, this chapter has focussed on the interrelationships between the two sets of variables in the Punjab. It can hardly be overemphasized that the Punjab's rapid population growth during the twentieth century, particularly since 1921, has taken place as a consequence of sharply falling mortality connected with the diffusion of medical knowledge and improvement of health facilities. Thus, although the region experienced elimination of famine and expansion of its food base in the wake of irrigation development, its rapid population growth was not the result of the increased food supply. Rapid

population growth not only brings about enormous population pressure but obviously results in a sharp growth of agricultural labour force as well. The capacity of the agricultural sector to combat the mounting population pressure and to absorb the increased labour force depends on a region's ability to develop its agriculture horizontally or vertically or both. Likewise the Punjab experienced, since the turn of the century, expansion of agriculture into uncultivated areas as well as intensification of the currently cultivated lands; and the rate of intensification rose sharply after Independence in the wake of rapidly climbing population.

The chapter also examined the effects of growing ALF on agricultural land and productivity after Independence and found that, although the net sown area per capita ALF has declined steadily in all districts, food production per capita ALF increased in seven districts during the period 1951-61 and in eight districts in the succeeding period. Finally, a correlation analysis has revealed interesting regional variations in the association between various population and agricultural variables. The three Potwar districts - Rawalpindi, Campbellpur and Jhelum, with their rain-fed agriculture, form a separate category of agricultural performance. They contain the lowest shares of the Province's total cultivated area (2.7, 3.9 and 2.6 per cent respectively) and also make the lowest contribution to its food production (1.6, 2.0 and 1.4 per cent respectively). In addition, their per capita food productions are the lowest in the Punjab's districts (68, 157 and 100 kg). In the interrelationships of most population and agricultural variables, therefore, they form a separate pattern. But not all the other districts form a uniform pattern. The old canal colony districts, particularly Lyallpur, Multan and Sahiwal, with high population (arithmetic as well as rural) densities, high levels of urbanization and abundant water supplies through canals and the tube wells, stand in sharp contrast to the districts (such as Mianwali, Muzaffargarh and Dera Ghazi Khan) where canal water was introduced relatively late, after Independence. Moreover, the old canal colony districts with better infrastructure have benefitted more from the "Green Revolution" during and after the 1960's. Thus, the relationship between population growth and

agricultural change has assumed a different form in these districts which have increased agricultural intensities and productions at the same time and employed more labour per unit cultivated (or net sown) area. As a result, their high agricultural intensities are commensurate with their high population pressure reflected in the high population densities; and their change in terms of the two variables during the period 1961-72 has also been parallel.

The difference between the old canal colony districts and the newly colonized districts in terms of the relationship between agricultural change and population growth can also be viewed from a different perspective. The first phase of agricultural change in the region is its horizontal development whereby it expands into hitherto uncultivated land. Once a limit to that is reached, i.e. when the maximum amount of land has been brought under the plough, agriculture will spread vertically, and intensification will take place. Thus, whereas Mianwali, Muzaffargarh and Dera Ghazi Khan, and also parts of Sargodha, Bahawalpur and Rahimyar Khan, with newly introduced irrigation water and in-migrant agricultural population, are passing through the first stage, the old canal colony districts, with their high population densities and high land use intensities, have entered the second stage.

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CHAPTER VII

CONCLUSION

As stated in Section 1.3, the two major objectives of this study have been, firstly, to analyze the levels and trends of population growth and agricultural change in the Punjab - Pakistan's most populous, agriculturally most prosperous and economically most developed province - and, secondly, to compare and examine how changes experienced by the Province in terms of the population and agricultural variables are interrelated. Since it is region-oriented, throughout its course the study has maintained its emphasis on the regional variations of phenomena which it has examined in quantitative terms.

In view of the vastness of the area and the considerable variety of the data required, almost all statistical information used in the analysis has been drawn from official and semi-official sources. To a considerable extent, the availability of data has dictated the time period of analysis and the levels of resolution. Although the major emphasis, in terms of time period, has been on the two post-Independence intercensal periods, for a comprehensive understanding of the recent population-agricultural trends, an attempt has been made to study these in a historical perspective. Thus, population growth trends have been studied in broad terms since ancient times in the wider context of the subcontinent Indo-Pakistan, since the middle of the nineteenth century in the context of British Punjab and since the turn of the twentieth century for the present areas of the Punjab. Agricultural change, on the other hand, has been examined in broad terms since the last quarter of the nineteenth century when a revolutionary change started in the wake of canal irrigation development; but more elaborate analysis has been conducted for the periods 1951-61 and 1961-72. In order to avoid too frequent fluctuations in the agricultural inputs and outputs and thus to make the two series of data reasonably compatible, agricultural data have been averaged on a five-yearly basis. While population

statistics are available for the Punjab's present districts since 1901 and tehsils since 1951, data pertaining to agricultural and other economic variables are available only for districts and mostly since after Independence. Thus, although the analysis of population change has been conducted down to the "micro" level of tehsils for the post-Independence period, that of agricultural change is restricted to the "macro" level of divisions and "meso" level of districts. At all stages, investigation is first directed to comparison of the Punjab with Pakistan as a whole and with the country's other provinces; it then proceeds to examine the regional variations within the Province.

In its first part, the study has focussed on the analysis of population growth in the region. Generally speaking, the region's population is characterized by :

(i) a large population base coupled with a sharply climbing rate of growth, particularly in recent decades;

(ii) a rapidly declining mortality rate, particularly since 1921 and especially after Independence, and a near-constant high fertility level; resulting in a constantly high rate of natural increase;

(iii) the almost "closed" nature of the population of Pakistan characterized by a generally insignificant level or rather an absence of international migration particularly during the period of investigation - the government-induced emigration of "job seekers" to the Middle East has attained any importance only since the mid- 1970's;

(iv) an overwhelmingly large concentration of population in the rural areas, depending on land resources for their livelihood and resulting in high rural and nutritional densities.

Throughout historical times, the Indo-Pakistan subcontinent is believed to have contained one of the world's largest and densest populations. The areas constituting present-day Pakistan, in particular the Punjab, because of their situation in the cradle of the Indus Valley Civilization, occupied an important position in terms of economic prosperity and population concentration among the subcontinent's regions. During the zenith of the Civilization, for instance, the Punjab alone contained almost four fifths of the subcontinent's population. With the passage of time, however, the population size and also the growth rate experienced fluctuations - a rise during the periods of stable rule characterized by organized administration and economic prosperity; and a decline with the spread of anarchy and disorganization and due to irruptions from outside. Nevertheless, according to most sources, the population size of the Province, as that of the subcontinent as a whole, remained almost unchanged with an extremely slow rate of growth for about 2000 years before the beginning of colonial rule.

The advent of British rule marked a watershed in the region's economy and also in its demographic situation. It is clear that a state of disequilibrium in the man-resource relationship is initiated when a new system or a new technology is introduced in a society which is either discordant with the physical-social set-up or is assimilated without regard to the time factor i.e. at an uneven pace. This has been the case in the Punjab where, during the first quarter century of British rule, sweeping socioeconomic reforms and the basis for a steady economic change were introduced. This was followed by the introduction of canal irrigation technology which not only stimulated agricultural expansion and thus remedied food shortages and famines but also considerably improved the Province's traditional economic structure. As, with the passage of time, more and more land came under the plough, the Punjab gradually became an agriculturally prosperous and economically rich province. In time, other facets of the region's economy received the government's attention and vast improvements in road and rail networks and sanitation and health facilities took place. The

Province's newly canal colonized areas were soon filled up by in-migrant cultivators from the other, relatively high density districts. In addition, a large proportion of the hitherto "unsettled" graziers were attracted to sedentary agriculture. Thus, the development of irrigation and the accompanying colonization played a vital role not only in economic progress but also in population redistribution in the Province and, therefore, brought about a sort of disequilibrium in its man-resource relationship. The populations of the canal colony districts started experiencing dramatic increases through in-migration as well as a higher natural increase resulting from the higher fertility level of the in-migrants.

The period 1921-31 marked another turning point in the region's economic-geodemographic situation when the changes introduced in irrigation, agriculture, industry, transport and commerce began to produce steady economic progress. In addition, not only did the government become better organized to grapple effectively with drought, floods, famines and epidemics but improvement in hygiene, sanitation and health facilities also greatly reduced the mortality level. This put the region's population on a launching pad for, with an appreciable reduction of the death rate and a continuing high birth rate, the rate of natural increase soared. Thus, whereas between 1901 and 1921 the Punjab increased its population by 14 per cent at an average annual rate of 0.7 per cent, because of high mortality resulting from wide spread famines and the outbreak of epidemics; during the next two decades the increase was more than thrice as much - 46 per cent at an average yearly rate of 1.9 per cent - facilitated by a sharp drop in mortality and steady socioeconomic progress. In 1947, the Province experienced a large scale loss of life as a result of its partition at Independence. Thus, the natural growth of population declined - albeit temporarily. In addition, in the wake of the unprecedented reshuffle of population, the districts with large net in-migrations increased their populations at exceptionally high rates.

The gap between the declines in fertility and mortality levels is nearly a world wide phenomenon, culminating in what is popularly known as the "population explosion". The main contributor to the widening gap between the two components of natural increase is the rapid decline in mortality made possible by the progress in medicine and hygiene and, to some extent, by the changing socioeconomic climate. Pakistan or the Punjab are no exception to such trends where the continued injection of cheap and easily available modern technology of death control has not only boosted the rate of natural growth but has also ultimately resulted in an inharmonious population - resource relationship. A closer look at the Province's gross population change between 1901 and 1972 reveals that 62 per cent of the net increase was added during the 1951-72 period. And, undoubtedly the main cause of this increase has been the sharply falling mortality rate, much sharper than it was during the first half of the twentieth century. The fertility rate, on the other hand, has maintained a near-constant level with a very small decrease. If the present trends of these components remain unchanged, the Province will contain over 85 million people at the end of the twentieth century, making a more than eight-fold increase since 1901; and increasing its arithmetic density to 414 per sq km. from 50 at the dawn of the century.

Successive governments in Pakistan have taken cognizance of the country's high fertility level and its impact on the nation's development effort, and have focussed attention on lowering fertility by means of population planning programmes. However, owing to the high level of illiteracy, particularly among women, the high concentration of population in villages and the perpetuation of the traditional life style, no such programme has so far met an appreciable success. Thus, whereas CDR has fallen from 20 per thousand during the 1951-60 period to 12.5 in the following decade, CBR declined by only a very small margin - from 47.5 to 46 per thousand over the same period. This has frustrated the governments' attempt to cut back the rate of natural increase. In its latest policy document, the Fifth Five Year Plan (1978-83), the government has

once again pledged to bring down the country's CBR through an effective population planning programme embodying an improved motivation, increased supply of contraceptives and improvement of living standards particularly in the rural areas. However, the diffusion of literacy, so vital a prerequisite for such programmes, is a difficult undertaking in such massive populations. Similarly, although the rural-urban ratio is constantly falling, a major change in the residential composition of the population is a phenomenon of the distant future. Without a dramatic change in the region's economic structure or in its agricultural techniques, large families will continue as an economic necessity; and the dominance of religious and patriarchal values in the tradition-bound populace will make a substantial decline in fertility impossible until at least the end of the century. Mortality, on the other hand, will continue falling with the spread of health facilities and a continued injection of preventive and curative modern drugs. Thus it can be predicted that the region's natural population growth will maintain a high level for quite some time. Even if a drastic change were to occur and the rate of natural increase were to be reduced to a very low level, the generations already born will continue exerting pressure on the region's resources for at least another quarter of a century.

An important social change that augurs well for fertility decline in the region is the gradual rise in the mean age at marriage attributable in particular to a general improvement in socioeconomic conditions and diffusion of education. The small reduction experienced by the Province in its fertility rates during the last twenty years should perhaps be attributed more to this factor than to the use of contraceptives. No doubt, development acts as an effective contraceptive. Thus, if attention is focussed on a greater diffusion of education, mass literacy, improvement of the education and socioeconomic status of women, inculcation of a general sense of well-being, improvement of maternity and child welfare and reduction in infant mortality, and the introduction of some sort of social security for old age, the fertility level is bound to come down.

Similarly, the introduction of mechanization in agriculture - albeit at a moderate pace - can reduce the economic importance of large families in the countryside; and the development of means to absorb the surplus agricultural labour in non-agricultural callings in situ can not only contribute to the uplift of rural areas but is also bound to reduce their CBRs.

In an agro-rural economy no other sector is as exposed to the effects of rapid population growth as is agriculture. Rural areas have, therefore, borne the brunt of rising population pressure, particularly after Independence; and one response to this has been population redistribution through rural-urban and rural-rural migrations. Not only has the rural-urban migration been propelled by "push" and "pull" forces but rural-rural migration has also been prompted by the same forces. Thus, whereas the high density old canal colony districts with their rising land values have exerted "push" on their rural populations, the newly opened agricultural lands in the newly canal irrigated districts within and outside the Province have attracted the farming classes.

The growing level of urbanization notwithstanding, a map of the Punjab's population distribution is basically that of its rural density. The investigation of the Province's patterns of population distribution revealed the following salient characteristics :

(i) The unevenness of population distribution is primarily linked with agricultural resources; thus the larger the agricultural and food producing capacity of a district, the larger is its population size.

(ii) In the arid and semi-arid setting of the Province, water is the main constraint on agriculture; thus the larger the irrigated area of a district, the larger is its population size.

(iii) The changes in population densities during the past 100

years or so bear a close relation to the provision of irrigation water.

Until the mid-1960's, the exploitation of ground water in the Potwar, trans-Indus and trans-Sutlej districts was regarded an impractical and unprofitable undertaking. However, after the dramatic success of tube wells in the central doabs, the ground water technology was also introduced in these districts where it proved an unqualified success through its propitious effects on agriculture. It can, therefore, be suggested that the use of this technology in these districts be promoted through loans and subsidies. In addition, the construction of small storage dams should be speedily completed, particularly in the Potwar region and Dera Ghazi Khan where a large number of small streams are so far unharnessed. The increase in water availability can not only improve agricultural performance in these districts but can also influence their population growth patterns by arresting out-migration and improving the population-resource relationship.

Not only has agriculture strong interaction and interconnection with population distribution in the Privince, it is also, despite a considerable decline in its share of the GNP during the two decades after Independence, the back-bone of Pakistan's economy. This is manifested by agriculture's predominance in employment, fulfilling over nine tenths of the country's food requirements, supplying raw materials to the industries and its overwhelming contribution in the foreign exchange earning. In its second part, the study analyzed the region's agricultural change mainly during the post-Independence period, which was characterized by :

(i) a general stagnation of agriculture in the 1950's, reflected in the low levels of crop production and yields and with frustrating effects on the nation's development effort; due mainly to the after-effects of Partition, vagaries of nature

such as failing monsoons, floods, soil erosion, waterlogging and salinity, pest and diseases and locust visitations, low price level and a low profit margin vis-a-vis other economic sectors, a complete lack of modern inputs, and a general neglect by the government;

(ii) a resuscitation of agriculture in the 1960's; first, with the development of ground water resources and regulation of canal water supply; and then, with the introduction of the "Green Revolution" technology characterized by the increased use of non-traditional inputs; and government's revised policy characterized mainly by the introduction of land reforms, provision of economic stimuli to the farmers and establishment of a new, down to the grass-roots level, local government system - the Basic Democracies.

To establish facts on a country's agricultural performance is extremely difficult. However, of all the physical, economic, social and political factors at play, water has been the overriding vehicle of agricultural change in the predominantly arid and semi-arid Punjab. Thus, whereas population pressure in some districts has induced a change in the cropping patterns and intensities and crop production and yields, the actual change has been mostly engineered and achieved by the increased water supply.

The relationship between population growth and agricultural change has been at once an old and a new topic. After Malthus spelled out in his Essay the nature of this relationship in a scientific perspective, the common attitude has been that population growth affects development adversely. This was challenged by some economists and population scientists, most notably Clark and Boserup who have presented historical evidence that population growth stimulates economic development. The present study takes into consideration

most such concepts and then attempts to examine the interrelationship between the two sets of variables in the Punjab.

A close interconnection between population density and the productivity of land is a universal phenomenon, particularly in the Third World. The Punjab presents a striking case where the changes in population and agriculture have been intimately interlinked particularly since the revolutionary innovations in its irrigation technology beginning in the last quarter of the nineteenth century. In its final stage, the study has investigated the interrelationships between population and agriculture in the Province after Independence. A necessary outcome of the rapid population growth is the sharp increase of the agricultural labour force which has, in turn, far-reaching implications in agriculture in numerous ways. In the Punjab, where the regional distribution of the ALF closely conforms with that of total foodgrain production, a 121.6 per cent growth of the ALF between 1951 and 1972 caused declines of 42.1 and 10.6 per cent respectively in the net sown area and foodgrain production per capita ALF. But for the booming productions linked with the "Green Revolution", the per capita labour productivity could have declined by a greater margin.

In order to have a closer look on the interrelationships between the two families of variables, a correlation analysis was conducted for the Punjab's 19 districts between a large number of population and agricultural variables. It was found that the correlation is :

(i) strong between the total (and rural) population and the net sown and total cropped areas, but moderate between the changes in terms of these variables;

(ii) strong between the net sown area and the agricultural labour force;

(iii) moderately strong between the TDR (and RDR) and the change in net sown area;

(iv) strong between the cropping intensity and arithmetic density (or rural density), but moderate between the changes in terms of these variables;

(v) very strong between rural population and foodgrain production;

(vi) moderately strong between the per capita food production and TDR, between change in foodgrain production and TDR, and between change in foodgrain area and arithmetic density;

(vii) strong between the use of modern inputs e.g. chemical fertilizer, tractor and tube well water, and strong between the level of mechanization (characterized by tractor use) and the following : total population, rural density, change in rural density and net in-migration.

The analysis also revealed that population pressure has by and large acted as a catalyst for the agricultural development process. Thus, the first response to the rising population/land ratio has been the horizontal growth of agriculture i.e. its expansion into hitherto uncultivated areas; and the second response has been the vertical development in agriculture i.e. the shortening of the recovery periods for the land or, in other words, intensification. This is reflected by a strong correlation between measures of population pressure such as arithmetic density, rural density, total dependency ratio and rural dependency ratio, and the increases in cropping intensity, total cropped area and food production.

Another important finding of the analysis was the differential response to population pressure by different districts depending on their physical, economic and demographic endowments. The three Potwar districts - Rawalpindi, Campbellpur and Jhelum - with their dry mountainous terrain, poor population-carrying capacity, small cultivable area and barani agriculture, contain the

lowest shares of the Province's total cultivated area and with the lowest yields make the lowest contribution to its food output. Almost devoid of irrigation, these districts do not use chemical fertilizer, improved seeds and modern innovations and their cropping intensities are also among the lowest. The sixteen districts of the Punjab Plain, on the other hand, with their large populations, high man/land ratios, elaborate canal and tube well irrigation system, high level of urbanization, high land use intensities, greater use of non-traditional inputs and better overall infrastructure have shown remarkable increases in cropping intensities and food and cash crop production with dramatically rising yields. However, there are sharp regional contrasts within these districts in terms of crop production and yield, not only at the "micro" level of tehsils or from village to village and farm to farm but also from district to district. The old canal colony districts such as Lyallpur, Multan and Sahiwal are steps ahead of the districts with newly introduced canal and tube well water.

To summarize, the present study has made an attempt to analyze the patterns of population and agricultural change and their interrelationships; and has revealed some possible patterns of association between the two families of variables. The change in agricultural inputs and outputs which is possibly linked with population pressure has been investigated at the "meso" level of districts. Change in cropping intensity and agricultural technology or, in Boserup's terminology, in the fallow system may have far-reaching interaction with the mode of rural life since social organization, land tenure and numerous other factors are intricately interwoven. Thus, in order to have a deeper insight into the rationale and mechanism of the interlinkage between the two sets of variables, there is a greater need to conduct such inquiries at the "micro" level, provided adequate and reliable data are available. This will answer, inter alia, the vital questions: how far the increase in rural population per se induces farmers to intensify, change and produce more; and how far a change in demand through urbanization and industrialization influences agricultural development process.

There is also a need to study and compare similar experiences in other countries and regions. Finally, it may be suggested that, to be realistic and effective, all planning must be region-oriented; and the national planning machinery must adopt a population-oriented policy in the formulation of regional development plans.

APPENDICES

LIST OF APPENDICES

APPENDIX I

URBAN POPULATION IN THE PUNJAB BY DIVISIONS AND DISTRICTS, 1901-72

Division/District	1901	1911	1921	1931	1941	1951	1961	1972
I. RAWALPINDI DIV.	187,953	197,765	217,973	270,441	400,937	549,847	752,174	1,341,565
1. RWP	89,532	88,188	104,434	121,264	187,464	287,951	406,523	771,602
2. CPR	21,287	29,763	32,115	49,032	60,662	57,252	71,910	122,669
3. JLM	35,241	36,668	35,404	42,873	56,471	77,275	105,569	168,267
4. GJT	41,893	43,146	46,020	57,272	96,340	127,369	168,072	279,027
II. SARGODHA DIV.	130,832	155,631	210,910	300,060	415,164	690,166	1,172,424	2,067,483
5. SRG	55,852	56,426	74,241	99,711	134,622	213,616	284,339	493,695
6. MWI	18,766	25,974	29,940	38,137	52,477	88,204	142,196	236,064
7. JNG	40,067	39,999	57,014	76,953	101,738	135,307	172,808	284,707
8. LYP	16,147	33,232	49,715	85,259	126,327	283,039	573,081	1,053,016
III. LAHORE DIV.	392,359	418,897	491,024	776,456	1,170,657	1,529,316	2,194,193	3,641,420
9. LHR	237,346	263,613	320,441	492,847	750,936	980,821	1,465,056	2,421,507
10. SLT	77,368	89,459	87,135	134,847	186,466	220,396	254,582	383,414
11. GWA	73,171	61,343	75,834	115,912	179,446	245,482	337,872	590,616
12. SHA	4,474	4,482	7,614	32,850	53,809	82,617	136,683	245,883
IV. MULTAN DIV.	185,937	188,476	191,115	280,190	423,063	625,500	986,693	1,538,902
13. MTN	108,651	105,577	97,183	137,280	212,565	341,307	576,969	883,648
14. SWL	12,794	16,041	21,819	52,574	91,051	154,833	239,334	388,472
15. MZG	21,216	22,724	26,019	30,898	42,239	54,361	72,953	119,888
16. DGK	43,276	44,134	46,094	59,438	77,208	74,999	97,437	146,894
V. BAHAWALPUR DIV.	42,098	37,078	30,962	36,470	116,322	192,101	355,049	593,325
17. BWP	33,487	27,886	26,749	31,239	67,493	89,633	138,351	224,842
18. BWN	-	-	-	-	24,436	50,644	102,800	164,337
19. RYK	8,611	9,192	4,213	5,231	24,393	51,824	113,898	204,146
PUNJAB	939,179	997,847	1,141,984	1,663,617	2,526,143	3,586,930	5,460,513	9,182,695

SOURCES : 1. Census of Pakistan 1961
2. District Census Reports 1972 (19 vols)

APPENDIX II

RURAL POPULATION IN THE PUNJAB BY DIVISIONS AND DISTRICTS, 1901-72

Division/District	1901	1911	1921	1931	1941	1951	1961	1972
I. RAWALPINDI DIV.	2,128,759	2,168,909	2,164,614	2,411,379	2,794,779	2,889,517	3,132,851	4,338,896
1. RWP	469,167	459,639	464,790	513,093	597,767	620,376	702,830	976,083
2. CPR	443,143	489,510	480,134	534,928	615,213	633,049	628,421	859,065
3. JLM	466,183	474,907	441,664	498,203	573,187	604,786	643,660	883,597
4. GJT	750,266	744,853	778,026	865,155	1,008,612	1,031,306	1,157,940	1,620,151
II. SARGODHA DIV.	1,671,461	2,191,922	2,405,835	2,764,504	3,308,014	4,052,945	4,804,515	6,931,895
5. SRG	432,297	588,575	645,677	721,779	864,299	949,372	1,183,282	1,607,259
6. MNI	283,144	315,403	328,265	373,402	453,844	492,295	604,537	859,566
7. JNG	386,158	484,804	513,545	587,880	719,893	741,454	905,939	1,276,299
8. LYP	569,862	803,140	918,348	1,081,443	1,269,978	1,869,824	2,110,757	3,188,769
III. LAHORE DIV.	2,928,394	2,695,487	2,859,499	3,096,003	3,589,127	3,810,557	4,254,382	6,193,416
9. LHR	652,892	622,775	681,515	720,127	762,104	914,407	1,014,631	1,352,500
10. SLT	1,090,302	992,638	1,003,581	1,092,133	1,295,536	1,253,857	1,341,801	1,960,511
11. GWA	666,375	544,239	547,747	620,226	732,788	801,550	954,014	1,469,139
12. SHA	518,825	535,835	626,656	663,517	798,699	840,743	943,936	1,411,266
IV. MULTAN DIV.	1,967,518	2,192,852	2,438,009	2,991,192	3,724,818	4,680,167	5,616,231	8,012,786
13. MTN	591,576	695,878	781,963	1,022,269	1,271,768	1,766,296	2,125,385	3,123,808
14. SWL	416,880	465,924	663,871	947,198	1,238,052	1,661,287	1,894,738	2,448,417
15. MZG	506,465	546,737	542,459	560,477	670,610	696,889	916,925	1,445,007
16. DGK	452,597	484,313	449,716	461,248	544,388	555,695	679,183	995,554
V. BAHAWALPUR DIV.	678,779	743,563	750,229	948,142	1,224,887	1,631,024	2,219,017	2,950,471
17. BWP	175,264	198,171	199,468	253,885	320,895	438,309	597,173	846,184
18. BWN	249,320	269,990	270,180	340,534	439,429	579,894	720,027	909,554
19. RYK	254,195	275,402	280,581	353,723	464,563	612,821	901,817	1,194,733
PUNJAB	9,374,911	9,992,733	10,618,186	12,211,220	14,641,625	17,064,210	20,026,996	28,427,464

SOURCES : As in Appendix I

APPENDIX III GROWTH OF TOTAL POPULATION IN THE PUNJAB'S TEHSILS, 1951-72

Tehsils	Total Population			Change (%)		
	1951	1961	1972	1951-61	1961-72	1951-72
1 RAWALPINDI	474991	613100	993019	29.1	62.0	109.1
2 MURREE	99679	117870	187649	18.2	59.2	88.3
3 KAHUTA	123810	146346	218795	18.2	49.5	76.7
4 GUJARKHAN	209847	232137	348222	10.6	50.0	65.9
5 CAMPBELLPUR	233394	243698	345217	4.4	41.7	47.9
6 FATEHJANG	143972	93923	129149	-34.8	37.5	-10.3
7 PINDIGHEB	164333	189991	266876	15.6	40.5	62.4
8 TALAGANG	148602	172719	240492	16.2	39.2	61.8
9 JHELUM	265770	291193	423670	9.6	45.5	59.4
10 CHAKWAL	222338	243157	325660	9.4	33.9	46.5
11 PIND DADAN KHAN	193953	214879	302534	10.8	40.8	56.0
12 GUJRAT	396630	433340	624917	9.3	44.2	57.6
13 KHARIAN	346442	401705	552428	16.0	37.5	59.5
14 PHALIA	415603	490967	721833	18.1	47.0	73.7
15 SARGODHA	404794	511168	719303	26.3	40.7	77.7
16 BHALWAL	311432	375685	522228	20.6	39.0	67.7
17 SHAHPUR	175397	217339	311793	23.9	43.5	77.8
18 KHUSHAB	271365	363429	547631	33.9	50.7	101.8
19 MIANWALI	240136	318266	441140	32.5	38.6	83.7
20 ISAKHEL	75891	95585	153994	26.0	61.1	102.9
21 BHAKKAR	234472	332882	500498	42.0	50.4	113.5
22 JHANG	349279	441471	630621	26.4	42.8	80.5
23 CHINIOT	330094	396948	570775	20.3	43.8	72.9
24 SHORKOT	197388	240328	359610	21.8	49.6	82.2
25 LYALLPUR	702074	1023128	1705118	45.7	66.7	142.9
26 JARANWALA	437987	483042	737838	10.3	52.7	68.5
27 SAMUNDRI	408904	484127	720800	18.4	48.9	76.3
28 TOBATEK SINGH	603898	693541	1078029	14.8	55.4	78.5
29 LAHORE	1134900	1625810	2587621	43.3	59.2	128.0
30 KASUR	369589	434975	587355	17.7	35.0	58.9
31 CHUNIAN	390739	418902	599031	7.2	43.0	53.3
32 SIALKOT	418393	456478	645971	9.1	41.5	54.4
33 PASRUR	251991	257101	373721	2.0	45.4	48.3
34 NAROWAL	251732	266153	385878	5.7	45.0	53.3
35 SHAKARGARH	260757	284272	448623	9.0	57.8	72.0
36 DASKA	291380	332379	489732	14.1	47.3	68.1
37 GUJRANWALA	578223	745393	1245258	28.9	67.1	115.4
38 WAZIRABAD	217198	254715	370310	17.3	45.4	70.5
39 HAFIZABAD	251611	291778	444187	16.0	52.2	76.5
40 SHEIKHUPURA	454283	529167	840954	16.5	58.9	85.1
41 FIROZWALA	220455	258990	396911	17.5	53.3	80.0
42 NANKANA SAHAB	248622	292462	419284	17.6	43.4	68.6
43 MULTAN	506815	721026	1115438	42.3	54.7	120.1
44 SHUJABAD	218392	262789	390785	20.3	48.7	78.9
45 KABIRWALA	251234	309754	402783	23.3	30.0	60.3
46 KHANEWAL	384398	464947	665210	21.0	43.1	73.1
47 VEHARI	272944	354714	532848	30.0	50.2	95.2
48 MAILSI	184732	225561	341599	22.1	51.4	84.9
49 LODHRAN	289088	363563	558793	25.8	53.7	93.3
50 SAHIWAL	603854	743614	944656	23.1	27.0	56.4
51 OKARA	423941	495544	623622	16.9	25.8	47.1
52 DIPALPUR	306540	331901	499997	8.2	50.6	63.1
53 PAKPATTAN	481685	563013	768614	16.9	36.5	59.6
54 MUZAFFARGARH	234856	290985	420514	23.9	44.5	79.1
55 LEIAH	162203	273224	495537	68.4	81.4	205.5
56 KOT ADDU	143009	184639	313137	29.1	69.6	119.6
57 ALIPUR	211182	241029	335707	14.1	39.3	59.0
58 DERA GHAZI KHAN	238147	310946	464679	30.6	49.4	95.1
59 TAUNSA	104005	116729	162082	12.2	38.9	55.8
60 JAMPUR	111955	129331	200786	15.5	55.2	79.3
61 RAJANPUR	131571	167721	250206	27.5	49.2	90.2
62 BALUCH TRACT	45016	51893	64695	15.3	24.7	43.7
63 BAHAWALPUR	211520	326671	495832	54.4	51.8	134.4
64 HASILPUR	128430	168172	230876	30.9	37.3	79.8
65 AHMEDPUR EAST	187992	240681	344318	28.0	43.1	83.2
66 BAHAWALNAGAR	182710	228598	309199	25.1	35.3	69.2
67 MINCHINABAD	118845	138200	185985	16.3	34.6	56.5
68 CHISHTIAN	148923	197437	254448	32.6	28.9	70.9
69 FORT ABBAS	180059	258592	324259	43.6	25.4	80.1
70 RAHIMYAR KHAN	248381	323393	436677	30.2	35.0	75.8
71 LIAQATPUR	144638	227940	305251	57.6	33.9	111.0
72 KHANPUR	108446	227722	325447	110.0	42.9	200.1
73 SADIQABAD	163160	236660	331504	45.0	40.1	103.2

SOURCE : computed from: District Census Reports 1972 (19 Vols.)

APPENDIX IV GROWTH OF URBAN POPULATION IN THE PUNJAB'S TEHSILS, 1951-72

Tehsils	Urban Population			Change (%)		
	1951	1961	1972	1951-61	1961-72	1951-72
1 RAWALPINDI	270042	377210	722319	39.7	91.5	167.5
2 MURREE	9486	13486	17065	43.4	26.5	81.4
3 KAHUTA	0	4393	8097	—	84.1	—
4 GUJARKHAN	8503	11529	24121	35.6	109.2	183.7
5 CAMPBELLPUR	33213	40087	72988	20.7	82.1	119.8
6 FATEHJANG	5127	5989	10662	16.8	78.0	108.0
7 PINDIGHEB	10157	15016	21624	47.8	44.0	112.9
8 TALAGANG	8755	10818	17395	23.6	60.8	98.7
9 JHELUM	56617	52535	94109	-7.1	79.0	66.2
10 CHAKWAL	13319	23310	37321	75.0	60.1	180.2
11 PIND DADAN KHAN	7339	29674	36837	304.3	24.1	401.9
12 GUJRAT	73952	86483	142677	16.9	65.0	92.9
13 KHARIAN	30126	51155	73162	69.8	43.0	142.9
14 PHALIA	23281	30434	63188	30.7	107.6	171.4
15 SARGODHA	85680	137130	210734	60.0	53.7	146.0
16 BHALWAL	49749	47558	95769	-4.4	101.4	92.5
17 SHAHPUR	29019	32084	62049	10.6	93.4	113.8
18 KHUSHAB	49168	67557	125144	37.4	85.2	154.5
19 MIANWALI	23341	86507	148745	270.6	71.9	537.3
20 ISAKHEL	16889	16684	26525	-1.2	59.0	57.1
21 BHAKKAR	17974	39035	60794	117.0	55.9	238.2
22 JHANG	73402	94971	131843	29.4	38.8	79.6
23 CHINIOT	50111	64232	96565	28.2	50.3	92.7
24 SHORKOT	11794	13605	56299	15.4	313.8	377.4
25 LYALLPUR	187202	435117	839621	132.4	93.0	348.5
26 JARANWALA	17969	26953	46494	50.0	72.5	158.7
27 SAMUNDRI	16736	23078	29717	37.9	28.8	77.6
28 TOBATEK SINGH	61132	87933	137184	43.8	56.0	124.4
29 LAHORE	859364	1317119	2198890	53.3	66.9	155.9
30 KASUR	99109	114516	154943	15.5	35.3	56.3
31 CHUNIAN	22348	33421	67674	49.5	102.5	202.8
32 SIALKOT	167543	167294	203650	-0.1	21.7	21.6
33 PASRUR	17261	18628	37421	7.9	100.9	116.8
34 NAROWAL	15298	31400	44773	105.3	42.6	192.7
35 SHAKARGARH	0	9104	20201	—	121.9	—
36 DASKA	20294	28156	77769	38.7	174.8	281.2
37 GUJRANWALA	154414	241070	438468	56.1	81.9	184.0
38 WAZIRABAD	54202	55014	80512	1.5	46.3	48.5
39 HAFIZABAD	36866	41788	71636	13.4	71.4	94.3
40 SHEIKHUPURA	56962	91585	166887	60.8	82.2	193.0
41 FIROZWALA	9056	21387	42492	136.2	98.7	369.2
42 NANKANA SAHAB	16599	23711	36504	42.8	54.0	119.9
43 MULTAN	190122	358201	538949	88.4	50.5	183.5
44 SHUJABAD	23089	25565	36562	10.7	43.0	58.4
45 KABIRWALA	9485	11970	24430	26.2	104.1	157.6
46 KHANEWAL	58002	88288	127996	52.2	45.0	120.7
47 VEHARI	24369	49647	85987	103.7	73.2	252.9
48 MAILSI	10242	13517	21318	33.0	56.6	108.1
49 LODHRAN	25998	29681	48406	14.2	63.1	86.2
50 SAHIWAL	62268	96560	140712	55.1	45.7	126.0
51 OKARA	40333	76166	112851	88.8	48.2	179.8
52 DIPALPUR	16369	20076	64710	22.6	222.3	295.3
53 PAKPATTAN	35863	46532	70199	29.7	50.9	95.7
54 MUZAFFARGARH	15679	19845	31923	26.6	60.9	103.6
55 LEIAH	17498	25175	42003	43.9	66.8	140.0
56 KOT ADDU	10507	16180	24759	54.0	53.0	135.6
57 ALIPUR	10677	11753	21203	10.1	80.4	98.6
58 DERA GHAZI KHAN	38932	49978	75856	28.4	51.8	94.8
59 TAUNSA	10113	16006	23555	58.3	47.2	132.9
60 JAMPUR	16999	16849	26265	-0.9	55.9	54.5
61 RAJANPUR	8955	14604	21218	63.1	45.3	136.9
62 BALUCH TRACT	0	0	0	0.0	0.0	0.0
63 BAHAWALPUR	41646	84377	145979	102.6	73.0	250.5
64 BASILPUR	11760	16068	27060	36.6	68.4	130.1
65 AHMEDPUR EAST	36227	37906	51803	4.6	36.7	43.0
66 BAHAWALNAGAR	18373	36290	64035	97.5	76.5	248.5
67 MINCHINABAD	9488	10912	14930	15.0	36.8	57.4
68 CHISHTIAN	10270	26041	38496	153.6	47.8	274.8
69 FORT ABBAS	12513	29557	46876	136.2	58.6	274.6
70 RAHIMYAR KHAN	16635	45561	89010	173.9	95.4	435.1
71 LIAQATPUR	2725	8088	12886	196.8	59.3	372.9
72 KHANPUR	19918	35754	54746	79.5	53.1	174.9
73 SADIQABAD	12546	24495	47504	95.2	93.9	278.6

SOURCE : Computed from: District Census Reports 1972 (19 Vols.)

APPENDIX V GROWTH OF RURAL POPULATION IN THE PUNJAB'S TEHSILS, 1951-72

Tehsils	Rural Population			Change (%)		
	1951	1961	1972	1951-61	1961-72	1951-72
1 RAWALPINDI	204949	235894	270700	15.1	14.8	32.1
2 MURREE	90273	104384	170584	15.6	63.4	89.0
3 KAHUTA	123810	141948	210698	14.6	48.4	70.2
4 GUJARKHAN	201344	220608	324101	9.6	46.9	61.0
5 CAMPBELLPUR	200181	203611	272229	1.7	33.7	36.0
6 FATEHJANG	138845	87934	118487	-36.7	34.7	-14 7
7 PINDIGHEB	154176	174975	245252	13.5	40.2	59.1
8 TALAGANG	139847	161901	223097	15.8	37.8	59.5
9 JHELUM	209153	238608	329561	14.1	38.1	57.6
10 CHAKWAL	209019	219847	288339	5.2	31.2	37.9
11 PIND DADAN KHAN	186614	185205	265697	-0.8	43.5	42.4
12 GUJRAT	322668	346857	482240	7.5	39.0	49.5
13 KHARIAN	316316	350550	479266	10.8	36.7	51.5
14 PHALIA	392322	460533	658645	17.4	43.0	67.9
15 SARGODHA	319114	374038	508569	17.2	36.0	59.4
16 BHALWAL	261683	328127	426459	25.4	30.0	63.0
17 SHAHPUR	146378	185255	249744	26.6	34.8	70.6
18 KHUSHAB	222197	295862	422487	33.2	42.8	90.1
19 MIANWALI	216795	231759	292395	6.9	26.2	34.9
20 ISAKHEL	59002	78901	127469	33.7	61.6	116.0
21 BHAKKAR	216498	293877	439704	35.7	49.6	103.1
22 JHANG	275877	346500	498778	25.6	43.9	80.8
23 CHINIOT	279983	332716	474210	18.8	42.5	69.4
24 SHORKOT	185594	226723	303311	22.2	33.8	63.4
25 LYALLPUR	514872	588011	865497	14.2	47.2	68.1
26 JARANWALA	420018	456089	691344	8.6	51.6	64.6
27 SAMUNDRI	392168	461049	691083	17.6	49.9	76.2
28 TOBATEK SINGH	542766	605608	940845	11.6	55.4	73.3
29 LAHORE	275536	308691	388731	12.0	25.9	41.1
30 KASUR	270480	320459	432412	18.5	34.9	59.9
31 CHUNIAN	368391	385481	531357	4.6	37.8	44.2
32 SIALKOT	250850	289184	442321	15.3	53.0	76.3
33 PASRUR	234730	238473	336300	1.6	41.0	43.3
34 NAROWAL	236434	234753	341105	-0.7	45.3	44.3
35 SHAKARGARH	260757	275168	428422	5.5	55.7	64.3
36 DASKA	271086	304223	412363	12.2	35.5	52.1
37 GUJRANWALA	423809	504323	806790	19.0	60.0	90.4
38 WAZIRABAD	162996	199701	289798	22.5	45.1	77.8
39 HAFIZABAD	214745	249990	372551	16.4	49.0	73.5
40 SHEIKHUPURA	397321	437582	674067	10.1	54.0	69.7
41 FIROZWALA	211399	237603	354419	12.4	49.2	67.7
42 NANKANA SAHAB	232023	268751	382780	15.8	42.4	65.0
43 MULTAN	316693	362825	576489	14.6	58.9	82.0
44 SHUJABAD	195303	237224	354223	21.5	49.3	81.4
45 KABIRWALA	241749	297784	378353	23.2	27.1	56.5
46 KHANEWAL	326396	376659	537214	15.4	42.6	64.6
47 VEHARI	248575	305067	446861	22.7	46.5	79.8
48 MAILSI	174490	211944	320281	21.5	51.1	83.6
49 LODHRAN	263093	333882	510387	26.9	52.9	94.0
50 SAHIWAL	541586	647054	803944	19.5	24.2	48.4
51 OKARA	383608	419378	510771	9.3	21.8	33.1
52 DIPALPUR	290271	311825	435287	7.4	39.6	50.0
53 PAKPATTAN	445822	516481	698415	15.8	35.2	56.7
54 MUZAFFARGARH	219177	271141	388591	23.7	43.3	77.3
55 LEIAH	144705	248049	453534	71.4	82.8	213.4
56 KOT ADDU	132582	168459	288378	27.1	71.2	117.6
57 ALIPUR	200585	229276	314504	14.3	37.2	56.9
58 DERA GHAZI KHAN	199215	260968	388823	31.0	49.0	95.2
59 TAUNSA	93892	100723	138527	7.3	37.5	47.5
60 JAMPUR	94956	112482	174521	18.5	55.2	83.8
61 RAJANPUR	122616	153117	228988	24.9	49.6	86.8
62 BALUCH TRACT	45016	51893	64695	15.3	24.7	43.7
63 BAHAWALPUR	169874	242294	349853	42.6	44.4	105.9
64 HASILPUR	116673	152104	203816	30.4	34.0	74.7
65 AHMEDPUR EAST	151765	202775	292515	33.6	44.3	92.7
66 BAHAWALNAGAR	164337	192308	245164	17.0	27.5	49.2
67 MINCHINABAD	109358	127288	171055	16.4	34.4	56.4
68 CHISHTIAN	138653	171396	215952	23.6	26.0	55.7
69 FORT ABBAS	167546	229035	277383	36.7	21.1	65.6
70 RAHIMYAR KHAN	231746	277832	347667	19.9	25.1	50.0
71 LIAQATPUR	141913	219352	292365	54.9	33.0	106.0
72 KHANPUR	88528	191963	270701	116.8	41.0	205.8
73 SADIQABAD	150634	212165	284000	40.8	33.9	88.5

SOURCE : Computed from: District Census Reports 1972 (19 Vols.)

APPENDIX VI

TOTAL CULTIVATED AREA OF PAKISTAN BY PROVINCES, 1951-1972.

Territory	1951(1)			1961(2)			1972(3)			% change		
	mill ha	% of Pakis-tan	% of Tot. Area	mill ha	% of Pakis-tan	% of Tot. Area	mill ha	% of Pakis-tan	% of Tot. Area	1951-61	1961-72	1951-72
Punjab(4)	9.1	59.9	44.2	10.0	57.5	48.5	11.1	57.8	53.9	9.9	11.0	22.0
Sind	4.6	30.2	32.6	4.8	27.5	34.0	5.3	27.6	37.6	4.3	10.4	15.2
NWF(5)	1.2	7.9	11.8	1.3	7.5	12.7	1.6	8.3	15.7	8.3	23.1	33.3
Baluchistan	0.3	2.0	0.9	1.3	7.5	3.7	1.2	6.3	3.5	333.3	-7.7	300.0
PAKISTAN	15.2	100.0	19.1	17.4	100.0	21.9	19.2	100.0	24.1	14.5	10.3	26.3

NOTES : (1) Average for the period 1948-9/1952-3
(2) " " 1958-9/1962-3
(3) " " 1970-1/1974-5
(4) Including Federal Capital Territory Islamabad
(5) Including Federally Administered Tribal Areas

SOURCES : Computed from 1. Agricultural Statistics of Pakistan 1975
2. Agricultural Statistics of Pakistan 1977

APPENDIX VII

NET SOWN AREA OF PAKISTAN BY PROVINCES, 1951-72

Territory	1951			1961			1972			% change		
	mill ha	% of Pakis-tan	% of Tot. Cultd	mill ha	% of Pakis-tan	% of Tot. Cultd	mill ha	% of Pakis-tan	% of Tot. Cultd	1951-61	1961-72	1951-72
Punjab	7.8	68.4	85.7	8.8	66.2	88.0	9.9	69.2	89.2	12.8	12.5	26.9
Sind	2.4	21.0	52.2	2.9	21.8	60.4	2.7	18.9	50.9	20.8	-6.9	12.5
NWF	1.0	8.8	83.3	1.1	8.3	84.6	1.3	9.1	81.3	10.0	18.2	30.0
Baluchistan	0.2	1.8	66.6	0.5	3.7	38.5	0.4	2.8	33.3	150.0	-20.0	100.0
PAKISTAN	11.4	100.0	75.0	13.3	100.0	76.4	14.3	100.0	74.5	16.7	7.5	25.4

NOTES AND SOURCES : As in Appendix VI

APPENDIX VIII TOTAL CROPPED AREA AND CROPPING INTENSITY OF PAKISTAN BY PROVINCES, 1951-72

Territory	TOTAL CROPPED AREA									Cropping Intensity (%)*		
	1951		1961		1972		% change					
	mill ha	% of Pakis-tan	mill ha	% of Pakis-tan	mill ha	% of Pakis-tan	1951-61	1961-72	1951-72	1951	1961	1972
Punjab	8.5	67.5	9.9	66.0	11.8	69.0	16.5	19.2	38.8	93.4	99.0	106.3
Sind	2.8	22.2	3.4	22.7	3.2	18.7	21.4	- 5.9	14.3	60.9	70.8	60.4
NWF	1.1	8.7	1.2	8.0	1.7	9.9	9.1	41.7	54.5	91.7	92.3	106.2
Baluchistan	0.2	1.6	0.5	3.3	0.4	2.3	150.0	-20.0	100.0	66.7	38.5	33.3
PAKISTAN	12.6	100.0	15.0	100.0	17.1	100.0	19.1	14.0	35.7	82.9	86.2	89.1

* Cropping Intensity = Total Cropped Area % of Total Cultivated

NOTES AND SOURCES : As in Appendix VI

APPENDIX IX

TOTAL IRRIGATED AREA OF PAKISTAN BY PROVINCES, 1951-72

Territory	1951			1961			1972			% change		
	mill ha	% of Pakis-tan	% of Tot. Crppd	mill ha	% of Pakis-tan	% of Tot. Crppd	mill ha	% of Pakis-tan	% of Tot. Crppd	1951-61	1961-72	1951-72
Punjab	5.9	64.1	69.4	7.1	66.3	71.7	9.2	70.8	78.0	20.3	29.6	55.9
Sind	2.7	29.4	96.4	2.9	27.1	85.3	2.7	20.8	84.4	7.4	-6.9	0.0
NWF	0.4	4.3	36.4	0.5	4.7	41.7	0.7	5.3	41.2	25.0	40.0	75.0
Baluchistan	0.2	2.2	100.0	0.2	1.9	40.0	0.4	3.1	100.0	0.0	100.0	100.0
PAKISTAN	9.2	100.0	73.0	10.7	100.0	71.3	13.0	100.0	76.0	16.3	21.5	41.3

NOTES AND SOURCES : As in Appendix VI

APPENDIX X

CANAL IRRIGATED AREA OF PAKISTAN BY PROVINCES, 1951-72

Territory	1951			1961			1972			% change		
	mill ha	% of Pakis-tan	% of Tot. Irrig	mill ha	% of Pakis-tan	% of Tot. Irrig	mill ha	% of Pakis-tan	% of Tot. Irrig	1951-61	1961-72	1951-72
Punjab	4.7	63.5	79.7	5.7	66.3	80.3	6.6	68.0	71.7	21.3	15.8	40.4
Sind	2.3	31.1	85.2	2.4	27.9	82.8	2.3	23.7	85.2	4.3	-4.2	0.0
NWF	0.3	4.0	75.0	0.4	4.6	80.0	0.6	6.2	85.7	33.3	50.0	100.0
Baluchistan	0.1	1.4	50.0	0.1	1.2	50.0	0.2	2.1	50.0	0.0	100.0	100.0
PAKISTAN	7.4	100.0	80.4	8.6	100.0	80.4	9.7	100.0	74.6	16.2	12.8	31.1

NOTES AND SOURCES : As in Appendix VI

APPENDIX XI

AREA, PRODUCTION AND AVERAGE YIELD OF FOODGRAINS IN PAKISTAN BY PROVINCES, 1951-72

Territory	AREA 000 ha			% change			PRODUCTION 000 tonnes			% change			YIELD quint/ha		
	1951 (1)	1961 (2)	1972 (3)	1951-61	1961-72	1951-72	1951	1961	1972	1951-61	1961-72	1951-72	1951	1961	1972
Punjab (4)	4,542	5,181	6,146	14.1	18.6	35.3	3,823	4,237	7,555	10.8	78.3	97.6	8.4	8.2	12.3
Sind	1,591	1,766	1,872	11.0	6.0	17.7	1,000	1,233	2,512	23.3	103.7	151.2	6.3	7.0	13.4
NWF (5)	787	861	1,162	9.4	35.0	47.6	520	638	1,031	22.7	61.6	98.3	6.6	7.4	8.9
Baluchistan	184	202	305	9.8	51.0	65.8	89	93	198	4.5	112.9	122.5	4.8	4.6	6.5
PAKISTAN	7,104	8,010	9,485	12.8	18.4	33.5	5,432	6,201	11,296	14.2	82.2	108.0	7.6	7.7	11.9

NOTES : (1) Average for the period 1948-9/1952-3
(2) " " 1958-9/1962-3
(3) " " 1970-1/1974-5
(4) Including Federal Capital Territory Islamabad
(5) Including Federally Administered Tribal Areas

SOURCES : Computed from 1. Agricultural Statistics of Pakistan 1975
2. Agricultural Statistics of Pakistan 1977

APPENDIX XII

AREA, PRODUCTION AND YIELD OF WHEAT IN PAKISTAN BY PROVINCES, 1951-72

Territory	AREA 000 ha			% change			PRODUCTION 000 tonnes			% change			YIELD quint/ha		
	1951	1961	1972	1951-61	1961-72	1951-72	1951	1961	1972	1951-61	1961-72	1951-72	1951	1961	1972
Punjab	3,082	3,581	4,331	16.2	20.9	40.5	2,862	3,114	5,713	8.8	83.5	99.6	9.3	8.7	13.2
Sind	533	645	797	21.0	23.6	49.5	364	475	1,137	30.5	139.4	212.4	6.8	7.4	14.3
NWF	428	501	650	17.1	29.7	51.9	238	317	515	33.2	62.5	116.4	5.6	6.3	7.9
Baluchistan	110	133	164	20.9	23.3	49.1	53	58	93	9.4	60.3	75.5	4.8	4.4	5.7
PAKISTAN	4,153	4,860	5,942	17.0	22.3	43.1	3,517	3,964	7,458	12.7	88.1	112.1	8.5	8.2	12.6

NOTES AND SOURCES : As in Appendix XI

APPENDIX XIII

AREA, PRODUCTION AND YIELD OF RICE IN PAKISTAN BY PROVINCES, 1951-72

Territory	AREA 000 ha			% change			PRODUCTION 000 tonnes			% change			YIELD quint/ha		
	1951	1961	1972	1951-61	1961-72	1951-72	1951	1961	1972	1951-61	1961-72	1951-72	1951	1961	1972
Punjab	340	533	761	56.8	42.8	123.8	324	483	1,087	49.1	125.1	235.5	9.5	9.1	14.3
Sind	542	620	688	14.4	11.0	26.9	454	536	1,159	18.1	116.2	155.3	8.4	8.6	16.8
NWF	15	15	56	0.0	273.3	273.3	10	13	68	30.0	423.1	580.0	6.7	8.7	12.1
Baluchistan	26	28	38	7.7	35.7	46.2	17	23	36	35.3	56.5	111.8	6.5	8.2	9.5
PAKISTAN	923	1,196	1,543	29.6	29.0	67.2	805	1,055	2,350	31.1	122.7	191.9	8.7	8.8	15.2

NOTES AND SOURCES : As in Appendix XI

APPENDIX XIV

AREA, PRODUCTION AND YIELD OF COTTON IN PAKISTAN BY PROVINCES, 1951-72

Territory	AREA 000 ha			AREA % change			PRODUCTION 000 tonnes			PRODUCTION % change			YIELD quint/ha		
	1951	1961	1972	1951-61	1961-72	1951-72	1951	1961	1972	1951-61	1961-72	1951-72	1951	1961	1972
Punjab	867	934	1,500	7.7	60.6	73.0	158	219	464	38.6	111.9	193.7	1.8	2.3	3.1
Sind	364	410	453	12.6	10.5	24.5	78	97	185	24.4	90.7	137.2	2.1	2.4	4.1
NWF	4	4	2	0.0	-50.0	-50.0	1	1	1	0.0	0.0	0.0	2.5	2.5	5.0
Baluchistan	0	0	0	-	-	-	0	0	0	-	-	-	-	-	-
PAKISTAN	1,235	1,348	1,955	9.1	45.0	58.3	237	317	650	33.8	105.0	174.3	1.9	2.4	3.3

NOTES AND SOURCES : As in Appendix XI

APPENDIX XV

AREA, PRODUCTION AND YIELD OF SUGARCANE IN PAKISTAN BY PROVINCES, 1951-72

Territory	AREA 000 ha			AREA % change			PRODUCTION 000 tonnes			PRODUCTION % change			YIELD quint/ha		
	1951	1961	1972	1951-61	1961-72	1951-72	1951	1961	1972	1951-61	1961-72	1951-72	1951	1961	1972
Punjab	162	346	432	113.6	24.9	166.7	5,152	10,110	15,052	96.2	48.9	192.2	318.0	292.2	348.4
Sind	7	30	88	328.6	193.3	1,157.1	256	1,250	3,101	388.3	148.1	1,111.3	365.7	416.7	352.4
NWF	43	67	87	55.8	29.9	102.3	1,174	2.170	3,392	84.8	56.3	188.9	273.0	323.9	389.9
Baluchistan	0	0	0	-	-	-	0	0	0	-	-	-	-	-	-
PAKISTAN	212	443	607	109.0	37.0	186.3	6,582	13,530	21,545	105.6	59.2	227.3	310.5	305.4	354.9

NOTES AND SOURCES : As in Appendix XI

APPENDIX XVI

AREA, PRODUCTION AND AVERAGE YIELD OF FOODGRAINS, THE PUNJAB, DIVISIONS AND DISTRICTS, 1951-72

Division/District	AREA 000 ha			% change			PRODUCTION 000 tonnes			% change			YIELD quint/ha		
	1951 (1)	1961 (2)	1972 (3)	1951-61	1961-72	1951-72	1951	1961	1972	1951-61	1961-72	1951-72	1951	1961	1972
I.RAWALPINDI DIV.	1,003	1,087	1,133	8.4	4.2	13.0	591	660	671	11.7	1.7	13.5	5.9	6.1	5.9
1. RWP	173	211	223	22.0	5.7	28.9	100	116	119	16.0	2.6	19.0	5.8	5.5	5.3
2. CPR	333	340	333	2.1	-2.1	0.0	169	188	154	11.2	-18.1	-8.9	5.1	5.5	4.6
3. JLM	215	229	220	6.5	-3.9	2.3	119	134	105	12.6	-21.6	-11.8	5.5	5.9	4.8
4. GJT	282	307	357	8.9	16.3	26.6	203	222	293	9.4	32.0	44.3	7.2	7.2	8.2
II.SARGODHA DIV.	1,023	1,168	1,355	14.2	16.0	32.5	986	1,044	1,894	5.9	81.4	92.1	9.6	8.9	14.0
5. SRG	294	340	387	15.6	13.8	31.6	267	286	507	7.1	77.3	89.9	9.1	8.4	13.1
6. MWI	183	219	241	19.7	10.0	31.7	97	109	208	12.4	90.8	114.4	5.3	5.0	8.6
7. JNG	210	230	281	9.5	22.2	33.8	200	197	388	-1.5	97.0	94.0	9.5	8.6	13.8
8. LYP	336	379	446	12.8	17.7	32.7	422	452	791	7.1	75.0	87.4	12.6	11.9	17.7
III.LAHORE DIV.	941	1,125	1,524	19.6	35.5	62.0	828	921	1,907	11.2	107.1	130.3	8.8	8.2	12.5
9. LHR	138	185	285	34.1	54.1	106.5	113	154	373	30.3	142.2	230.1	8.2	8.3	13.1
10. SLT	285	353	415	23.9	17.6	45.6	226	256	426	13.3	66.4	88.5	7.9	7.3	10.3
11. GWA	270	322	452	19.3	40.4	67.4	237	276	615	16.5	122.8	159.5	8.8	8.6	13.6
12. SHA	248	265	372	6.9	40.4	50.0	252	235	493	-6.7	109.8	95.6	10.2	8.9	13.3
IV.MULTAN DIV.	1,120	1,280	1,553	14.3	21.3	38.7	1,103	1,172	2,415	6.3	106.1	118.9	9.8	9.2	15.6
13. MTN	414	463	524	11.8	13.2	26.6	448	507	898	13.2	77.1	100.4	10.8	11.0	17.1
14. SWL	333	387	473	16.2	22.2	42.0	374	395	855	5.6	116.5	128.6	11.2	10.2	18.1
15. MZG	182	228	319	25.3	39.9	75.3	156	158	432	1.3	173.4	176.9	8.6	6.9	13.5
16. DGK	191	202	237	5.8	17.3	24.1	125	112	230	-10.4	105.4	84.0	6.5	5.5	9.7
V.BAHAWALPUR DIV.	455	521	581	14.5	11.5	27.7	315	440	668	39.7	51.8	112.1	6.9	8.4	11.5
17. BWP	127	140	159	10.2	13.6	25.2	72	124	181	72.2	46.0	151.4	5.7	8.9	11.4
18. BWN	153	183	206	19.6	12.6	34.6	96	147	225	53.1	53.1	134.4	6.3	8.0	10.9
19. RYK	175	198	216	13.1	9.1	23.4	147	169	262	15.0	55.0	78.2	8.4	8.5	12.1
PUNJAB	4,542	5,181	6,146	14.1	18.6	35.3	3,823	4,237	7,555	10.8	78.3	97.6	8.4	8.2	12.3

NOTES : 1. Average for the period 1948-9/1952-3. 2. Average for the period 1958-9/1962-3. 3. Average for the period 1970-1/1974-5.

SOURCES: computed from:- 1. Statistics of West Pakistan Agricultural Data 1947-8/1958-9 2. West Pakistan Agricultural Statistics 1954-5/1964-5.
3. Punjab Agricultural Statistics 1965-6/1974-5 (8 vols)

APPENDIX XVII

AREA, PRODUCTION AND YIELD OF RICE, THE PUNJAB, DIVISIONS AND DISTRICTS, 1951-72

Division/District	AREA 000 ha			% change			PRODUCTION 000 tonnes			% change			YIELD quint/ha		
	1951	1961	1972	1951-61	1961-72	1951-72	1951	1961	1972	1951-61	1951-72	1951-72	1951	1961	1972
I. RAWALPINDI DIV.	16	31	41	93.8	32.3	156.3	15	32	61	113.3	90.6	306.7	9.4	10.3	14.9
1. RWP	0	0	0	-	-	-	0	0	0	-	-	-	-	-	-
2. CPR	0	0	0	-	-	-	0	0	0	-	-	-	-	-	-
3. JLM	0	0	0	-	-	-	0	0	0	-	-	-	-	-	-
4. GJT	16	31	41	93.8	32.3	156.3	15	32	61	113.3	90.6	306.7	9.4	10.3	14.9
II. SARGODHA DIV.	18	32	69	77.8	115.6	283.3	15	28	108	86.7	285.7	620.0	8.3	8.8	15.7
5. SRG	6	11	26	83.3	136.4	333.3	4	10	41	150.0	310.0	925.0	6.7	9.1	15.8
6. MWI	0	0	0	-	-	-	0	0	0	-	-	-	-	-	-
7. JNG	5	9	15	80.0	66.7	200.0	4	7	21	75.0	200.0	425.0	8.0	7.8	14.0
8. LYP	7	12	28	71.4	133.3	300.0	7	11	46	57.1	318.2	557.1	10.0	9.2	16.4
III. LAHORE DIV.	210	354	512	68.6	44.6	143.8	212	342	707	61.3	106.7	233.5	10.1	9.7	13.8
9. LHR	17	28	58	64.7	107.1	241.2	14	24	80	71.4	233.3	471.4	8.2	8.6	13.8
10. SLT	36	99	127	175.0	28.3	252.8	33	90	152	172.7	68.9	360.6	9.2	9.1	12.0
11. GWA	87	135	187	55.2	38.5	114.9	85	134	274	57.6	104.5	222.4	9.8	9.9	14.7
12. SHA	70	92	140	31.4	52.2	100.0	80	94	201	17.5	113.8	151.3	11.4	10.2	14.4
IV. MULTAN DIV.	76	93	105	22.4	12.9	38.2	67	65	169	-3.0	160.0	152.2	8.8	7.0	16.1
13. MTN	12	12	14	0.0	16.7	16.7	9	8	23	-11.1	187.5	155.6	7.5	6.7	16.4
14. SWL	35	49	60	40.0	22.4	71.4	35	41	107	17.1	161.0	205.7	10.0	8.4	17.8
15. MZG	8	9	11	12.5	22.2	37.5	7	6	15	-14.3	150.0	114.3	8.8	6.7	13.6
16. DGK	21	23	20	9.5	-13.0	-4.8	16	10	24	-37.5	140.0	50.0	7.6	4.3	12.0
V. BAHAWALPUR DIV.	20	23	34	15.0	47.8	70.0	15	16	42	6.7	162.5	180.0	7.5	7.0	12.4
17. BWP	3	4	7	33.3	75.0	133.3	2	3	8	50.0	166.7	300.0	6.7	7.5	11.4
18. BWN	7	10	14	42.9	40.0	100.0	6	7	18	16.7	157.1	200.0	8.6	7.0	12.9
19. RYK	10	9	13	-10.0	44.4	30.0	7	6	16	-14.3	166.7	128.6	7.0	6.7	12.3
PUNJAB	340	533	761	56.8	42.8	123.8	324	483	1,087	49.1	125.1	235.5	9.5	9.1	14.3

NOTES AND SOURCES : As in Appendix XVI

APPENDIX XVIII

AREA, PRODUCTION AND YIELD OF SUGARCANE, THE PUNJAB, DIVISIONS AND DISTRICTS, 1951-72

Division/District	AREA						PRODUCTION						YIELD		
	000 ha			% change			000 tonnes			% change			quint/ha		
	1951	1961	1972	1951-61	1961-72	1951-72	1951	1961	1972	1951-61	1961-72	1951-72	1951	1961	1972
I. RAWALPINDI DIV.	8	14	29	75.0	107.1	262.5	254	366	868	44.1	137.2	241.7	317.5	261.4	299.3
1. RWP	0	0	0	-	-	-	0	0	0	-	-	-	-	-	-
2. CPR	0	0	0	-	-	-	0	0	0	-	-	-	-	-	-
3. JLM	0	1	1	-	-	-		10	5	-	-50.0	-	-	100.0	50.0
4. GJT	8	13	28	62.5	115.4	250.0	254	356	863	40.2	142.4	239.8	317.5	273.8	308.2
II. SARGODHA DIV.	49	117	178	138.8	52.1	263.3	1,707	3,658	7,031	114.3	92.2	311.9	348.4	312.6	395.0
5. SRG	8	19	39	137.5	105.3	387.5	274	671	1,551	144.9	131.1	466.1	342.5	353.2	397.7
6. MWI	0	9	15	-	66.7	-	0	224	508	-	126.8	-	-	248.9	338.7
7. JNG	6	14	21	133.3	50.0	250.0	173	396	762	128.9	92.4	340.5	288.3	282.9	362.9
8. LYP	35	75	103	114.3	37.3	194.3	1,260	2,367	4,210	87.9	77.9	234.1	360.0	315.6	408.7
III. LAHORE DIV.	53	80	70	50.9	-12.5	32.1	1,524	1,941	2,440	27.4	25.7	60.1	287.5	242.6	348.6
9. LHR	10	24	25	140.0	4.2	150.0	264	569	861	115.5	51.3	226.1	264.0	237.1	344.4
10. SLT	19	22	12	15.8	-45.5	-36.8	579	488	390	-15.7	-20.1	-32.6	304.7	221.8	325.0
11. GWA	12	14	14	16.7	-	16.7	376	376	475	-	26.3	26.3	313.3	268.6	339.3
12. SHA	12	20	19	66.7	-5.0	58.3	305	508	714	66.6	40.6	134.1	254.2	254.0	375.8
IV. MULTAN DIV.	31	76	92	145.2	21.1	196.8	996	2,357	2,872	136.6	21.8	188.4	321.3	310.1	312.2
13. MTN	9	24	27	166.7	12.5	200.0	315	762	870	141.9	14.2	176.2	350.0	317.5	322.2
14. SWL	18	39	40	116.7	2.6	122.2	559	1,290	1,370	130.8	6.2	145.1	310.6	330.8	342.5
15. MZG	3	12	23	300.0	91.7	666.7	91	285	581	213.2	103.9	538.5	303.3	237.5	252.6
16. DGK	1	1	2	-	100.0	100.0	31	20	51	-35.5	155.0	64.5	310.0	200.0	255.0
V. BAHAWALPUR DIV.	21	59	63	181.0	6.8	200.0	671	1,788	1,841	166.5	3.0	174.4	319.5	303.1	292.2
17. BWP	5	11	12	120.0	9.1	140.0	163	346	354	112.3	2.3	117.2	326.0	314.5	295.0
18. BWN	10	21	22	110.0	4.8	120.0	315	660	653	109.5	-1.1	107.3	315.0	314.3	296.8
19. RYK	6	27	29	350.0	7.4	383.3	193	782	834	305.2	6.6	332.1	321.7	289.6	287.6
PUNJAB	162	346	432	113.6	24.9	166.7	5,152	10,110	15,052	96.2	48.9	192.2	318.0	292.2	348.4

NOTES AND SOURCES : As in Appendix XVI

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AAAG	:	Annals of the Association of American Geographers
AAAPSS	:	Annals of American Academy of Political and Social Sciences
EDCC	:	Economic Development and Cultural Change
IUSSP	:	International Union for the Scientific Study of Population
PGR	:	Pakistan Geographical Review
PDR	:	Pakistan Development Review
TESG	:	Tiddschrift voor Economische En Sociale Geografie
WPC	:	World Population Conference

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